FIRST AERO WEEKLY IN THE WORLD

FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

OFFICIAL ORGAN OF THE ROYAL AERO CLUB

No. 1292
Vol. XXV
No. 39

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FLIGHT

The AIRCRAFT ENGINEER AND AIRSHIPS

First Aeronautical Weekly in the World. Founded January, 1909

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice and Progress of Aerial Locomotion and Transport

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CONTENTS

DIARY OF CURRENT AND FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in this list:—

1933.

Sept. 27-28. International Air Traffic Association Bi-Annual Conference.
Sept. 29. Stage and Screen Ae.C. Gymkhana and Theatrical Garden Party, Hatfield.
Oct. 3. Junior Aero Club Annual Dinner at the Ham Bone Club at 8 p.m.
Oct. 7-8. B.G.A. Gliding and Soaring Competition.
Oct. 7-8. U.S. National Charity Air Pageant, Roosevelt Field, New York.
Oct. 12. "Air Traffic Control." Lecture by Maj. R. H. S. Mealing before R.Ae.S.
Oct. 21. Annual Reunion Dinner of No. 6 Wing, R.N.A.S., and Nos. 66 and 67 Wings, R.A.F.
Nov. 2. "Variable-Pitch Airscrew and Variable Gears." Lecture by W. G. Jennings before R.Ae.S.
Nov. 3. Norfolk and Norwich Aero Club Annual Ball, at Thatched Assembly Rooms, Norwich.
Nov. 16. "Stiffness of Aeroplane Wings." Lecture by H. Roxbee Cox before R.Ae.S.
Nov. 25. Comrades of the R.A.F. Reunion Dinner, at Thames House Restaurant, Millbank, S.W.1.
Nov. 30. "Tail Buffeting." Lecture by W. J. Duncan before R.Ae.S.
Dec. 7. "Possible Future Development of Aircraft Engines." Lecture by A. H. R. Fedden before R.Ae.S.
Dec. 8. Calshot Reunion Dinner, at R.A.F. Club, Piccadilly, W.1.
Dec. 14. "Light Alloys for Aeronautical Purposes." Lecture by L. Aitchison before R.Ae.S.
Dec. 15. Close of entries for International Touring Competition (1934), Poland.
Dec. 18-24. International Rally at Cairo and Meeting of the F.A.I.

1934.

Jan. 11. "Testing of Aircraft Landing Mechanisms and Some Factors Affecting Design." Lecture by W. D. Douglas before R.Ae.S.

EDITORIAL COMMENT

AT last the long-expected terms of tender for the air mail service between Singapore and Australia have been published by the Commonwealth Government, and they will be found on another page of this issue. They finally settle various points which have hitherto been in doubt. In the first place there will not be one main trunk line all the way from Singapore to some terminus in South-East Australia, with one branch line down the western coast to Perth. Singapore to Darwin is the first section. Then, there will be two routes down in South East Australia, branching off at Charleville. One of these routes will go from Charleville to Brisbane, the other from Charleville to Cootamundra. The west coast route will, as expected, follow the well-established route of West Australian Airways. Tenders may be made for the whole route or for one branch or section of a branch.

Singapore-Australia Tender Terms

The interesting point about the south-eastern route is the decision to have two termini. Originally it was announced that the terminus would be Cootamundra. This is a comparatively small town, which is said to have good railway connections with Sydney and Melbourne. When previously some Australian services were operating with single-engined aircraft, not elaborately equipped with wireless, it was thought that it would not be safe for them to fly between Cootamundra and Sydney, and so they stopped at the former town and put the mails on the railway. If, in the future, powerful modern commercial aeroplanes are used, such as the "Atalanta," this argument would have no force. Major Brackley, during his recent tour in Australia, flew the *Astraea* above the clouds and the mountains in this district and found no difficulty in navigating with his wireless. The selection of this town as the terminus in the original statement by the Australian Government has been the subject of much discussion in the Australian Press. It has been alleged that the choice of this unimportant

town was dictated by a fear of showing favour to either Sydney or Melbourne, two cities whose rivalry is notorious. It was the reluctance to decide between their claims which inspired the decision to build a new capital city at Canberra, and this shows the intensity of the feeling in Australia, a feeling which it is hard for us in Great Britain to appreciate. Another statement was made in the Australian papers, which seems more likely to have some truth in it, namely that the new airway must not be allowed to interfere with the interests of the State Railways. The State Railways are liable to exert considerable pressure in Government circles, and not very long ago the interests of these railways were seriously urged in the Parliament as a reason for abolishing the Government subsidy to the Perth-Adelaide air service. If the new airway from England were to follow the route Brisbane, Sydney, Melbourne, it might to some extent damage the interests of the railways. If it flies into the wilderness—so to speak—and there puts its mails on to trains travelling in two directions to the two great cities, then it will obviously help the railways. This consideration may have been the governing one with the authorities who drew up the tender terms. As this plan manifestly makes no provision for the Queensland capital, Brisbane, a branch line from Charleville to that city has been included in the scheme.

In a recent article we wrote that we refused to set up a great god Aeronautics and worship it. We advocated the use of aircraft for the sake of the service of mankind, not for the sake of making sacrifices to that deity. We hold the same opinions about railways. It does not seem to us to be the best thing for any body of mankind that the Rail should be exalted into a deity, and that sacrifices should be made on its altar. Of course we realise that as the Government, which is to say the public, of Australia has large sums of money invested in the State railways, it would be a disaster of great magnitude if those railways were to be ruined. We cannot see that air transport shows any signs of ruining railways in Australia or anywhere else. In fact the diminution of railway receipts which air transport is likely to cause must for a good many years to come be inconsiderable. It therefore seems to us that it is a pity to send the airway out into the wilderness in order to subordinate it to the interests of the railways—if, indeed, that is the motive which underlies the decision of the Australian authorities. There are times when a railway scores over an airway by travelling at night, and so delivers mails more expeditiously than the airway can do. We have not seen it stated that this will be a result of making Cootamundra the terminus of the airway from Croydon. An airway, however, is not such an immovable affair as a railway, and if Cootamundra is fixed as the terminus now, it does not follow that it will remain so until the crack of doom. Night flying will come in time, and then surely the only sensible route for the aeroplane flying from Darwin will be to traverse the line of three State capitals, Brisbane, Sydney, Melbourne.

Another point settled by the tender terms, which was not previously clear, is the relation of mails to passengers. We have a distinct recollection that some time ago the Defence Minister stated publicly that the Singapore service would be subsidised only on a mail basis. This is not to be the case. Mails are to take precedence everywhere, but it is stipulated that certain provision for passengers must be made. It will be seen that the number of obligatory passenger seats varies along different stages of the routes, though it is not to be supposed that the contractors will change their types of aircraft at every such stage.

It is satisfactory to note that the aircraft which ply between Singapore and Darwin must be multi-engined, and must be able to maintain level flight at 2,000 feet with one engine cut out when carrying not less than the minimum specified load. The machines to be used inland need not be multi-engined. Over great parts of the Australian plains it has been proved that single-engined machines can land almost anywhere without risk if the engine fails. The overseas aircraft must have a range of 600 miles against a 30-m.p.h. headwind, and the inland machines must similarly have a range of 300 miles.

The terms provide for a speeding up of the service after two years, from six days to five days between Singapore and Cootamundra, though tenderers are allowed to anticipate this and arrange for the higher speed from the first.

The tenders will not close until January 31 next, and it will be very interesting to see who will tender. We sincerely hope that the Commonwealth Government will choose the best tender, and not necessarily the lowest one.

❖ ❖ ❖ ❖

The Coast Defence Exercises

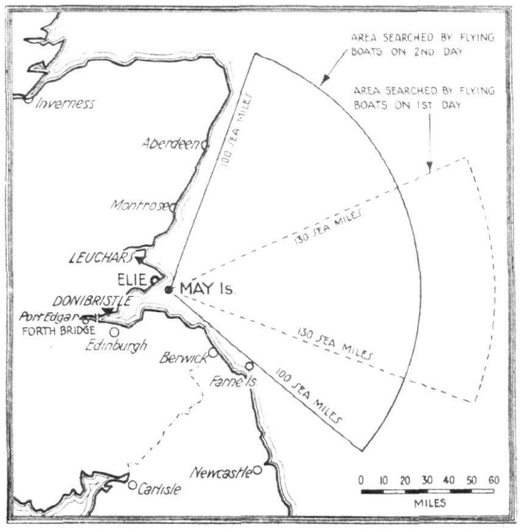
It would be a very bad day for Great Britain if any exercises were to prove that the Royal Navy is no longer her sure shield. Some rash journalists have tried to draw such a conclusion from the recent exercises in coast defence carried out off the Firth of Forth. Perhaps it is only Fleet Street human nature, but it appears that when a Press representative is given a seat in a bomber and that bomber sees a ship and fires a red Very light, the said Press representative cannot imagine that the ship has not been sent to the bottom. And when it is as easy as all that to sink a battleship, then why spend the taxpayers' money on building and maintaining the things? Sink the lot! Sack the lot!

Of course, no definite conclusions were to be drawn from these training exercises, but a few reflections were suggested to the mind. The first is that we need more squadrons of flying boats. They are a very fine long-range class, and given decent visibility they can see a lot. Another reflection is that although carriers may have their drawbacks, they do provide a great protection to the Fleet when the latter is attacked by hostile aircraft in strength. One can scarcely imagine one or two aircraft catapulted off each cruiser and capital ship providing sufficient air strength to prevent the fleet from being at least seriously incommoded when attacked by nine hostile squadrons, as happened last week. The question then arises: Can we armour the decks of the carriers without detracting from their utility as aerodromes?

THE COAST DEFENCE EXERCISES

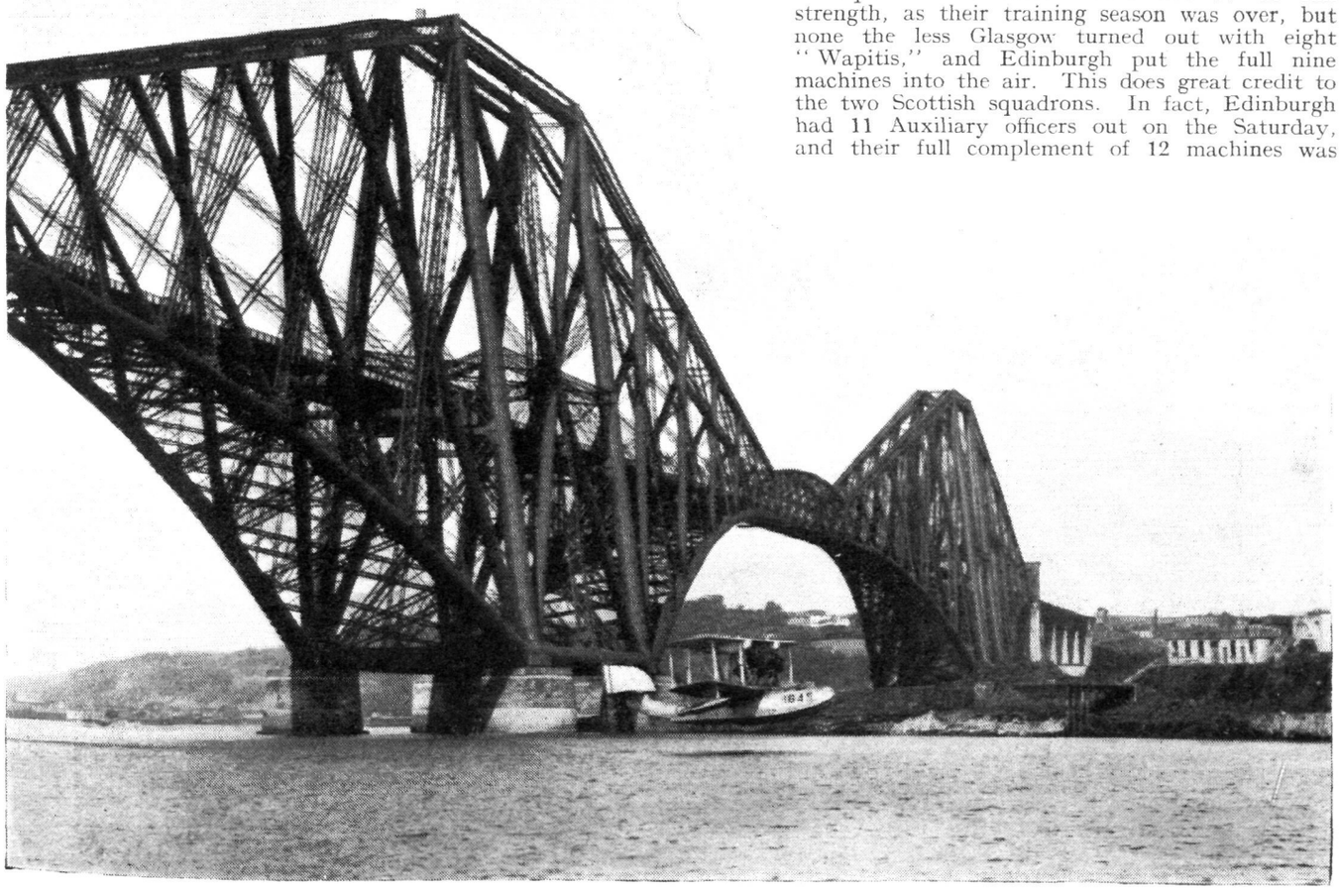
Flying and Fighting over the North Sea

By MAJOR F. A. de V. ROBERTSON

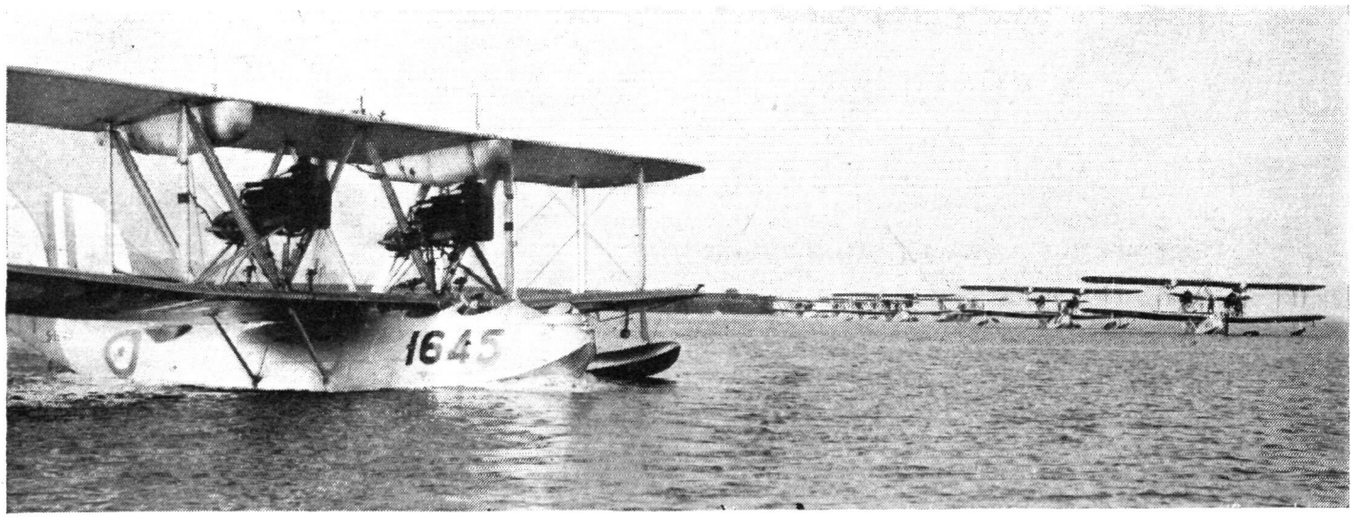


AS foretold in our last issue, the Coast Defence exercises by the Royal Navy and the Royal Air Force took place on Friday, September 22, and Saturday, the 23rd. Before describing the operations, I should like to emphasise once more that these were not manœuvres, only exercises. They were the first thing of the kind ever attempted, and neither the Admiralty nor the Air Ministry had any clear idea what would happen, or what would be needed to make such exercises realistic. Therefore, the scheme was kept as simple as possible, and artificial elements were deliberately introduced. The Fleet, for example, was only allowed to operate by day, and it had to close in on a shore fortress which was known to have strong air defences. Only bad weather would have given the Fleet much chance of evading the attacks of the defending, or Blue, aircraft, and the weather during both days of the exercises was for nearly all the time gloriously fine. Moreover, it was absolutely incorrect to describe the exercises, as some of the more sensational papers did, as a sham fight between the Navy and the Air Force. The Fleet included two carriers, and one of the points to be chiefly noted during the operations was the use made of the Fleet's aircraft. The aircraft on each side were approximately even in numbers, and in the result the fighting was very largely between the Fleet Air Arm on one side and the Wessex Bombing Area, aided by part of No. 1 Air Defence Group and by two squadrons of flying boats, on the other.

Let me first describe the positions of the Blue squadrons. These positions were kept secret from the Admiralty until the close of the exercises, but now they may be set forth. The headquarters of Air Marshal Clark-Hall, C.M.G., D.S.O., commanding the Blue force, were at Leuchars, in Fife. At that aerodrome he had No. 101 (Bomber) Squadron flying 10 "Sidestrands" (twin "Jupiters"). At Montrose was No. 40 (B.) Squadron with "Gordons" ("Panthers"). At Donibristle was stationed No. 811 (Torpedo Bomber) Squadron, flying 12 "Ripons," off the *Furious*, which had been lent by the Fleet Air Arm to the Blue force to take the place of No. 100 (B.) Squadron, which is packing up its "Vildebeestes" for a move to a new station. At Port Edgar, on the south bank of the Firth of Forth, just above the Forth Bridge, the two flying-boat squadrons, No. 201 from Calshot and No. 210 from Pembroke Dock, were stationed. Between them they mustered nine "Southamptons" (twin "Lions"), under the command of Wing Com. R. H. Kershaw. At Turnhouse were the two A.A.F. bomber squadrons, No. 602 (City of Glasgow) and No. 603 (City of Edinburgh). It had been anticipated that these would not be at full strength, as their training season was over, but none the less Glasgow turned out with eight "Wapitis," and Edinburgh put the full nine machines into the air. This does great credit to the two Scottish squadrons. In fact, Edinburgh had 11 Auxiliary officers out on the Saturday, and their full complement of 12 machines was



OFF FOR THE NORTH SEA: A Supermarine "Southampton" (two Napier "Lions") taking off under the Forth Bridge to search for the Fleet. (FLIGHT *Photo.*)



AT ZERO HOUR : At noon on Friday five " Southamptons " of Nos. 210 and 201 (F.B.) Squadrons left their moorings at Port Edgar and started off on long reconnaissance. (FLIGHT *Photo.*)

available. The two " Hart " squadrons, Nos. 12 and 33, used an ancient aerodrome at Gullane, west of North Berwick, as a refuelling station, though they spent Friday night at better equipped stations. The squadrons on the *Furious* and *Courageous* were given in our last issue. We may repeat them. On the *Furious* were No. 801 (Fleet Fighter) Squadron, with six " Nimrods," and No. 822 (Fleet Spotter Reconnaissance) Squadron, with 12 " 3F.'s." On the *Courageous* were No. 800 (F.F.) Squadron with nine " Nimrods " and three " Ospreys," No. 810 (Torpedo Bomber) Squadron with six " Darts " and six " Ripons," and No. 821 (F.S.R.) Squadron with nine " Seals."

Friday's Operations—The " Southamptons " Out at Sea

Early on Friday morning a haar lay over the Forth, but the war was not to start until noon, and before then an east wind had cleared the murk away, and most of the area lay in brilliant sunshine. That day the Blue bombers were not to put out to sea. Blue was to send out the flying boats to try to locate the Fleet. An attack on the fortress of Elie and perhaps on the Blue aerodromes by the Red bombers from the carriers was expected, and the two " Hart " squadrons were sent up as defensive aircraft to patrol over Blueland. I was to make a flight in one of the " Southamptons," and so was down at Port Edgar by 10.30 a.m. A Royal Air Force launch was drawn up by one of the derelict jetties of Port Edgar, while the nine boats looked splendid as they rode at their moorings out in the Forth. I remember Port Edgar in war time, when it was an Admiralty station of some importance, and I once, when on sick leave from France, saw a hospital train steam down the main pier and take off to hospital a large number of wounded naval ratings who had been brought in from some unchronicled fight in the North Sea. Since the war, no attempt has been made to keep the place in repair. The railway lines are rusted and overgrown with grass, and the wood of the jetties seems on the point of disintegration. It was low tide when I walked down the jetty and met Wing Com. Kershaw. Far, far down below lay the pinnace, and I wondered how on earth he had got up. There was one wooden post at the edge of the jetty, and they led me to that and pointed to a vertical iron ladder which led down to a plank which projected over the water and *almost* reached the bulwark of the pinnace. I said I did not like the look of it, and would prefer to go down by parachute. However, I could not get into the air unless I first went down that ladder, so grasping the wobbly and apparently disintegrating post, I contrived to accomplish the passage perilous. That was the only unpleasant moment in the day. The Wing Commander came down, too, and while we were in the cabin of the pinnace signing " blood chits " and being allocated to particular " Southamptons," a message came down that two squadron leaders from other units wanted to speak to the Wing Commander. He said, " Bring them down," to which the messenger replied, " They don't like the look of the ladder, sir." I am afraid that I chuckled. If intrepid bird-men did not fancy that ladder, then surely my qualms were excusable. But down they had to come.

Then I got into a motor dinghy and was taken out to boat S.1229. The flight lieutenant in command impressed on me the great importance of being warm, and I was not

" AS PANTS THE HART FOR COOLING STREAMS " : The machines of No. 33 (Bomber) Squadron just in from a raid gather round the petrol tank at Turnhouse Aerodrome. (FLIGHT *Photo.*)

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Flight photo.

THE WESTLAND WESSEX

3 - ENGINED MONOPLANE

A TYPE designed for use on regular Air Routes and for private charter. This machine is one of the six-seater "Wessex" operated by Messrs. Imperial Airways Limited, while an eight-seater version is employed on the G. W. Railway, Plymouth—Cardiff—Birmingham Air Service. "Wessex" machines are also in use on the SABENA (Belgian Air Lines) and the Portsmouth—Isle of Wight Ferry Service, etc. Available as a six or eight seater with four hours duration.

(Dunlop Wheels and Tyres Standard.)

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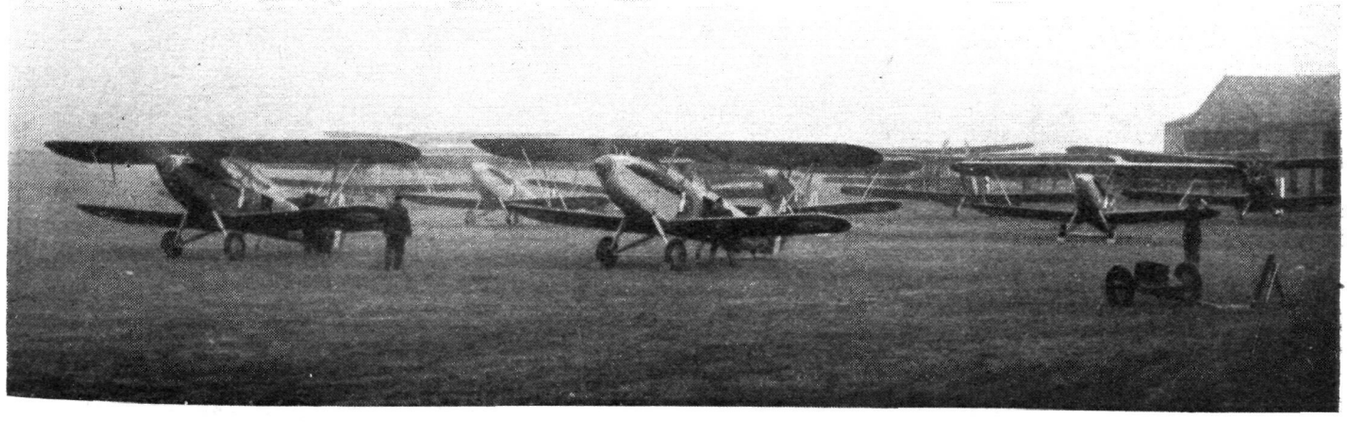
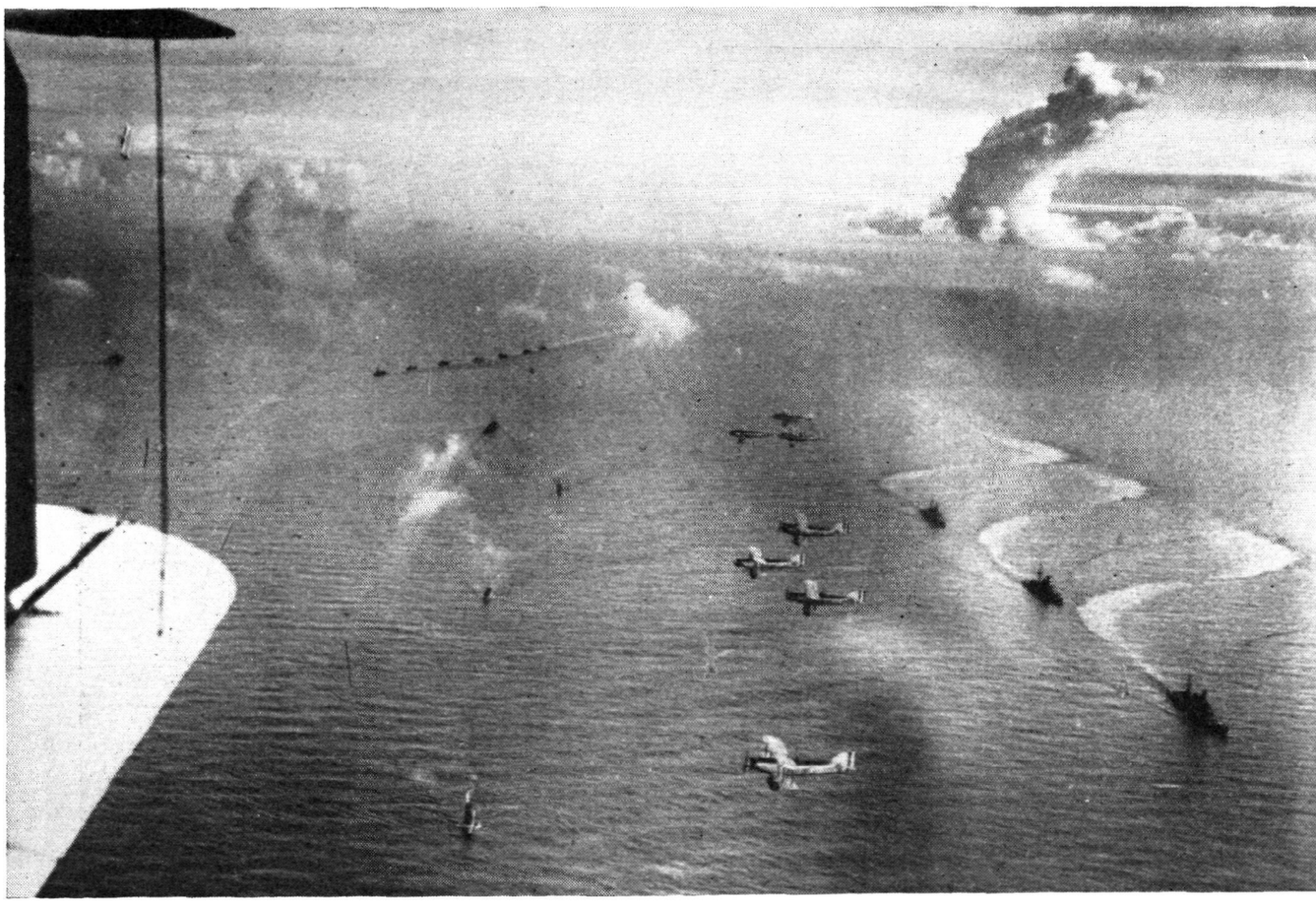
DEFENDING THEIR NATIVE SHORES : The " Wapitis " of No. 603 (City of Edinburgh) (Bomber) Squadron (which had no flotation gear) 30 miles out to sea to bomb the invaders. (FLIGHT *Photo.*)

in the least inclined to disagree with him. The blood of a man who has spent 12 years in India is somewhat thin. So I put on all the woollies which they gave me, and then struggled into a Sydcott. This was accomplished by my standing inside the boat with my head out of a rear cockpit, while a loudly amused airman on top of the hull grasped the Sydcott by the neck and pulled it up over my shoulders. A kindly flying officer fastened the fleece-lined boots on my feet, for at first I felt hardly able to move my arms in the Sydcott, but soon all was complete, and I felt like Tweedledum and Tweedledee when prepared to have a battle. The dinghy pushed off, taking the rigger and fitter, and a crew of four was left aboard with me. In addition to the flight lieutenant there was a second pilot, a navigator, and a wireless operator, all officers. Soon the " Lions " were started up, and the boats began to taxi about above the bridge. I saw a " 3F." seaplane on the water, and was told that the A.O.C. intended to come out in it with the boats, but I did not see it again. We taxied round, warming the engines, for about half an hour, and then at 12.00 hours we headed into wind, which was blowing up-stream, and took off.

It has always been one of my ambitions to fly down the Forth on a fine day, and it was gratified at last. Once before I had flown across from Midlothian to Fife, but the visibility was then very bad. Now, looking out of one of the rear cockpits, both of which were put at my disposal, I could thoroughly enjoy a really glorious view. Edinburgh, unfortunately, was justifying its title of Auld Reekie, though probably it was mist rather than smoke which hid it from view. I could see Arthur's Seat behind it, and the mass of Pentland hills. Musselburgh was also invisible, and I was disappointed at this, as I wanted to try to distinguish my old school there. But Inchkeith and the other islands in the Forth looked very attractive from above. I do not mean that they looked desirable as places of residence, but they made a very effective picture. The wooded hills of Fife also made a fine view. Five of the nine " Southamptons " were out on this reconnaissance, but we were not flying in formation. Now and again we could see one of our consorts, and we seemed to be flying higher than the rest, though we were then under



AT THE CRACK OF DAWN : Haar, or sea mist, enveloped Turnhouse Aerodrome on Saturday morning when the " Harts " of No. 33 (Bomber) Squadron took off to bomb the attacking Fleet. (FLIGHT *Photo.*)

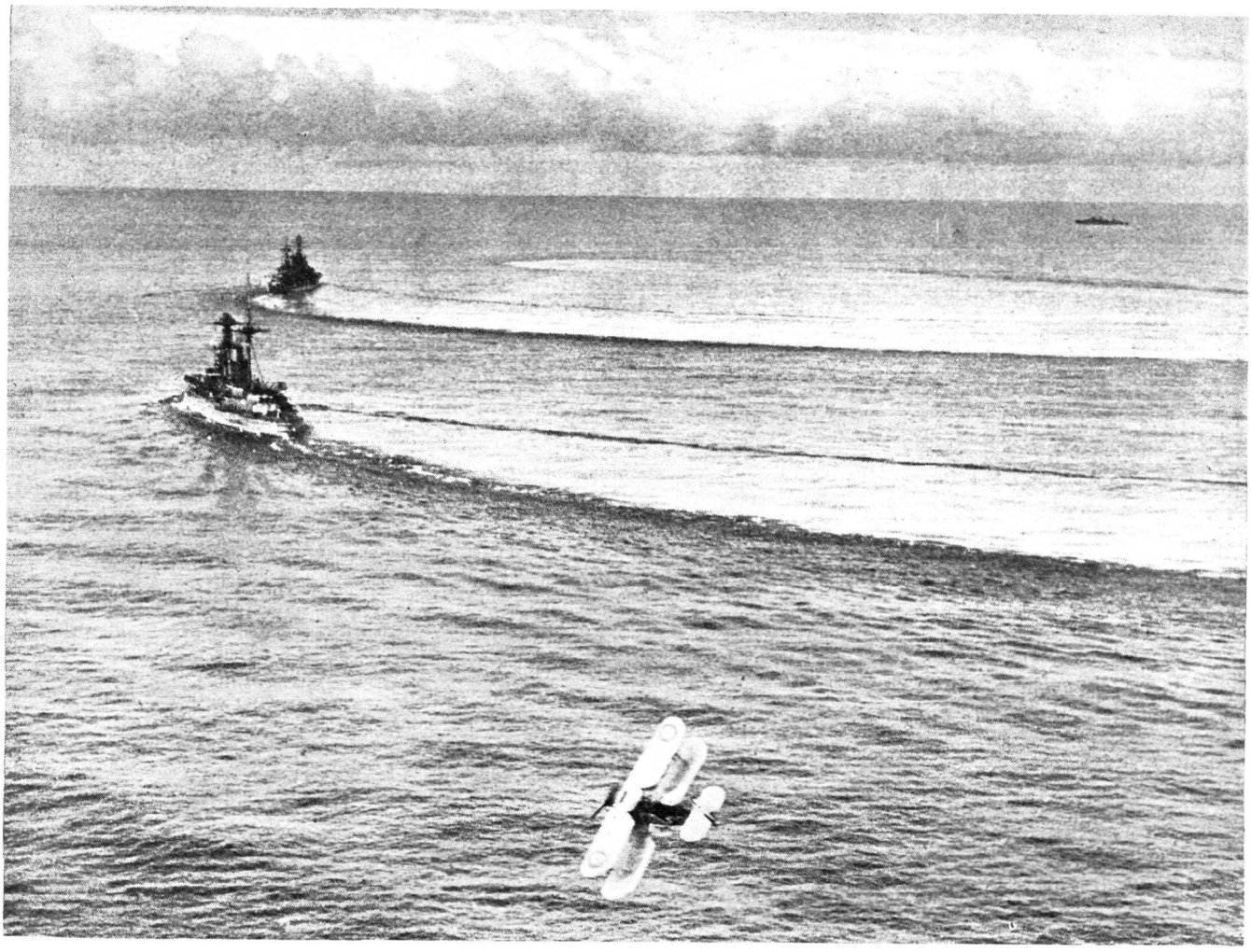


THE GAY " GORDONS " : No. 40 (Bomber) Squadron have just dropped bombs on the three capital ships, H.M.S. *Renown*, *Warspite* and *Malaya*. Destroyers are scurrying in all directions. Observe how the Main Fleet has changed direction to avoid the air attack.

2,000. When one sees an aircraft flying below one, it looks as if it can have no height at all, but must be right down on the surface of the water. Clouds below one give the same impression. The coast of Haddington was now fading away in the distance to the south, and that of Fife came to an abrupt end. Suddenly one of our consorts dived down and circled low over a rocky island, and we followed suit. I was told it was the Isle of May, the point at which the five boats were to spread out fanwise to reconnoitre our respective sectors. I suppose we were reporting to the island, though I know not who or what was on it. It looked a desolate rocky place, covered with scant green grass, with a lighthouse and two or three white-washed buildings on it. Then we headed out to sea.

About 13.00 hours we ran into a rainstorm, much to my surprise, as the weather forecast had not suggested anything of the sort. I am never fond of the look of a grey sea, and water below and water from above seems to me too much of a good thing. There was nothing to see, and not likely to be anything for some time, and I was getting rather tired of the slipstream from two " Lion " engines blowing on my head. The fur-lined helmet made it possible to stand the draught, but after a while one gets to want a little relief from the buffeting. So I came down inside the hull and sat on the row of lockers along the starboard side, which make quite a sufficiently comfortable seat. Sandwiches and a thermos cheered me up, and soon after I had finished my lunch we got out of the rain into absolutely brilliant sunshine. I had another look round, for the sun on the sea and the visibility of about 50 miles made a very fine sight. Flying the Channel is a charming experience, but it is quite a different thing from being right out to sea with no land in sight at all. The flight lieutenant passed me a message to say that he would let me know when ships might be expected. So I watched the wireless officer and the navigator at work. They sat facing each other at a table in the hull, and both were quite busy practically all the time. The second pilot lolled on the bottom of the hull just below the pilot and passed the message chits to and fro. As I afterwards learnt, the navigator was plotting our course with most remarkable accuracy, and at the end of the day, when we made landfall on our return, he was only three miles out in his reckoning. Considering the number of circles which we had made during the afternoon, this was extraordinarily good. The wireless officer was also kept very busy, and I think he hardly left his seat until the aerial was wound up in the evening. We were evidently a very conversational boat.

STARTING UP : Sqd. Ldr. Lord Clydesdale has brought the City of Glasgow (Bomber) Squadron over from Abbotsinch to Turnhouse, and they are about to take their " Wapitis " off on a raid.
(FLIGHT *Photo.*)



TORPEDO ATTACK : A Blackburn " Ripon " of No. 811 (Torpedo Bomber) Squadron of the Blue Force delivering an attack on H.M.S. *Malaya*. H.M.S. *Warspite*, the Red flagship, is ahead.

About 14.00 hours the second pilot waved to me and pointed delightedly to the south. I dashed for my cockpit and gazed out on our starboard beam. There, some miles ahead of us, were two small black smudges on the water, with long wakes trailing white behind them. Astern of each was another smaller dot, which would have been invisible to my eyes but for its wake. Evidently we had found two large ships, each with an attendant destroyer. I had already given up trying to use my binoculars as a bad job. The vibration made it impossible for me to see anything clearly through them, though apart from the inevitable vibration of the engines the " Southampton " was very steady, very much steadier than most London tube trains. I felt the contrast later that night when I got on to the top of an Edinburgh tram. Still, I strained my eyes at these two ships, and as we drew nearer could see the flat flying deck without any top-hamper of the carrier *Furious*. As additional evidence, the smoke was coming out horizontally from her stern. Then the other ship revealed herself as the *Courageous*, with the bridge rising up on one side of the top flying deck. They were steaming line abreast, with *Furious* nearest to us. I must say that, seen from a height of 4,000 ft. or more, the carriers did not look at all dignified specimens of the great British Navy. *Furious* in particular looked to me very like a slug crawling along the surface of the sea. Then I noticed in line to the port of the two carriers four destroyers, also in line abreast, and, in Army parlance, at wide intervals. A chit was passed to me, " Aircraft leaving carrier." Well, these fly-

SINEWS OF WAR : Barrels of petrol for the Blue Force at derelict Port Edgar.
(FLIGHT *Photo.*)

H.M.S. *Furious* **: The Fairey "3 F" machines of No. 822 (Fleet Spotter Reconnaissance) Squadron ready to take off from the deck of the carrier. Note the smoke issuing from below the flying deck.**

ing boat officers have good sea eyes. I could not distinguish any sign of such activity on either of the flying decks.

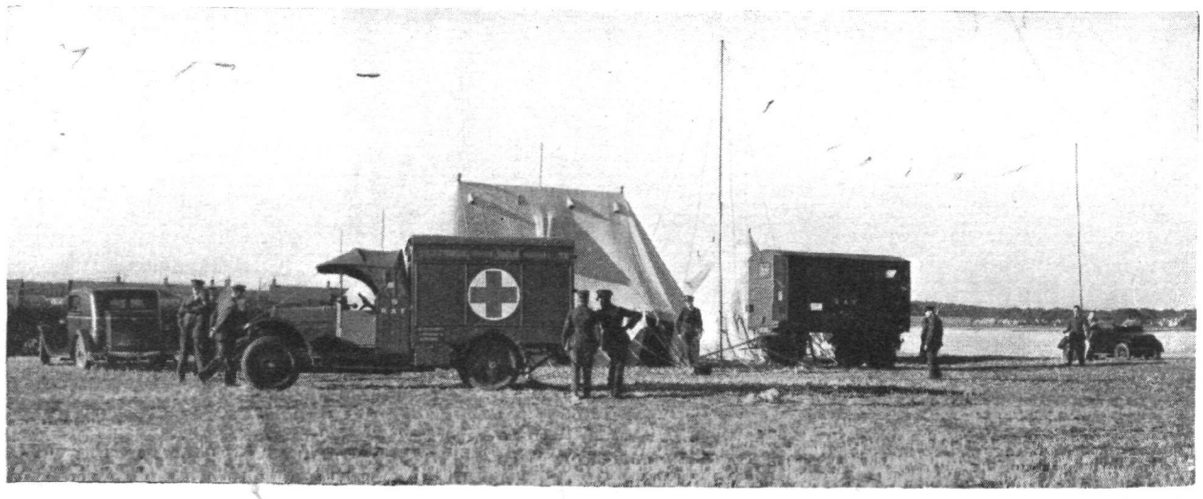
By this time our wireless officer had sent off a report which doubtless gladdened the hearts of Blue H.Q. at Leuchars. Our hearts were glad, too. We might have spent the whole day searching our sector and seen nothing, but actually we had flown right at the two carriers as if we had known the exact spot on which to look for them. The R.A.F. narrative that evening said that our report was "confirmed a few minutes later by another flying boat." I considered that wording almost an insult. What confirmation was needed? The other flying boat may also have seen the carriers, but what need of "confirmation"? Our eyes had not played us false, and even a landlubber like myself had seen that the two ships were carriers. No, they were our bag, and I decline to share the honour with anybody else.

We were about 80 miles out from May Island when we sighted the carriers, and we kept on our course for a while, and soon we saw another big ship some miles astern of the carriers, with her attendant destroyer. This proved to be the *Renown*. Then our pilot began to fly in large circles above the Fleet, always keeping the carriers in sight. They broke formation, and began to steam on irregular courses. The four destroyers kept on in line abreast imperturbably all the afternoon. They seemed to be intent on getting somewhere.

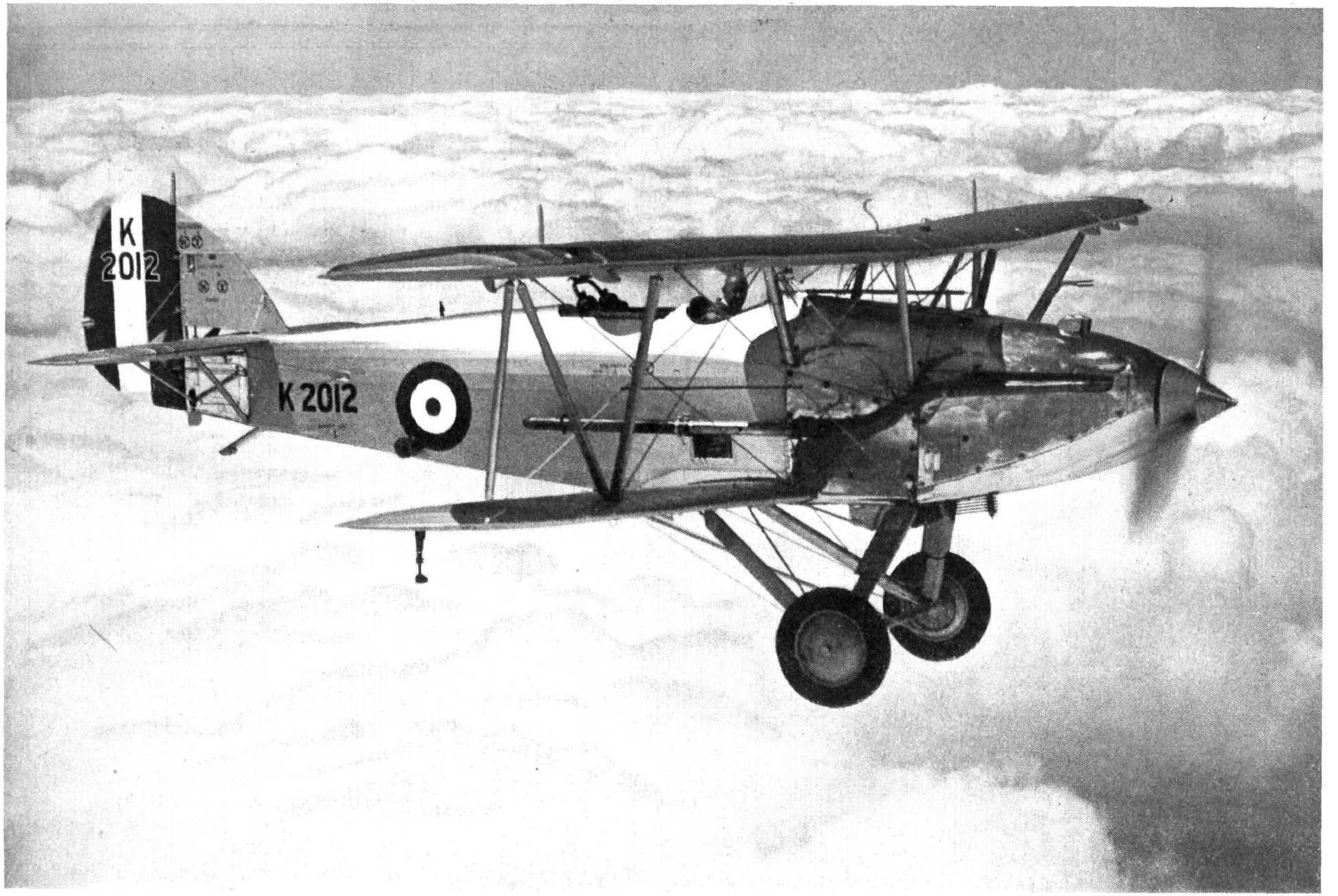
Air Attack

I was gazing down at the interesting scene on the water below, when our pilot started a rather sudden banking turn, and immediately after I saw three "Nimrods" in flight formation dive past us from behind on our starboard beam. The rule was that aircraft must not approach within 100 yards of each other, but they fired a green Very light to show that they had made an air attack. Almost immediately after a single machine flashed past underneath us, and I had not time to see if it was a "Nimrod" or an "Osprey." Probably it was the latter, which could use its rear gun as it passed below. Thereafter during the afternoon, at intervals of about half an hour, fighters would come and attack us. The later attacks were all by "Ospreys," and always by a whole flight in formation, which, of course, was unreal. But I did admire the skill with which our pilot banked and turned his boat so as always to bring the fighters under the fire of our three cockpits. Our guns were imaginary, but the manœuvring gave me some idea that a "Southampton" would not go down without peppering its assailants a bit. Two flying together would be more than twice as defensible.

No casualties were to be allowed in this war, so our

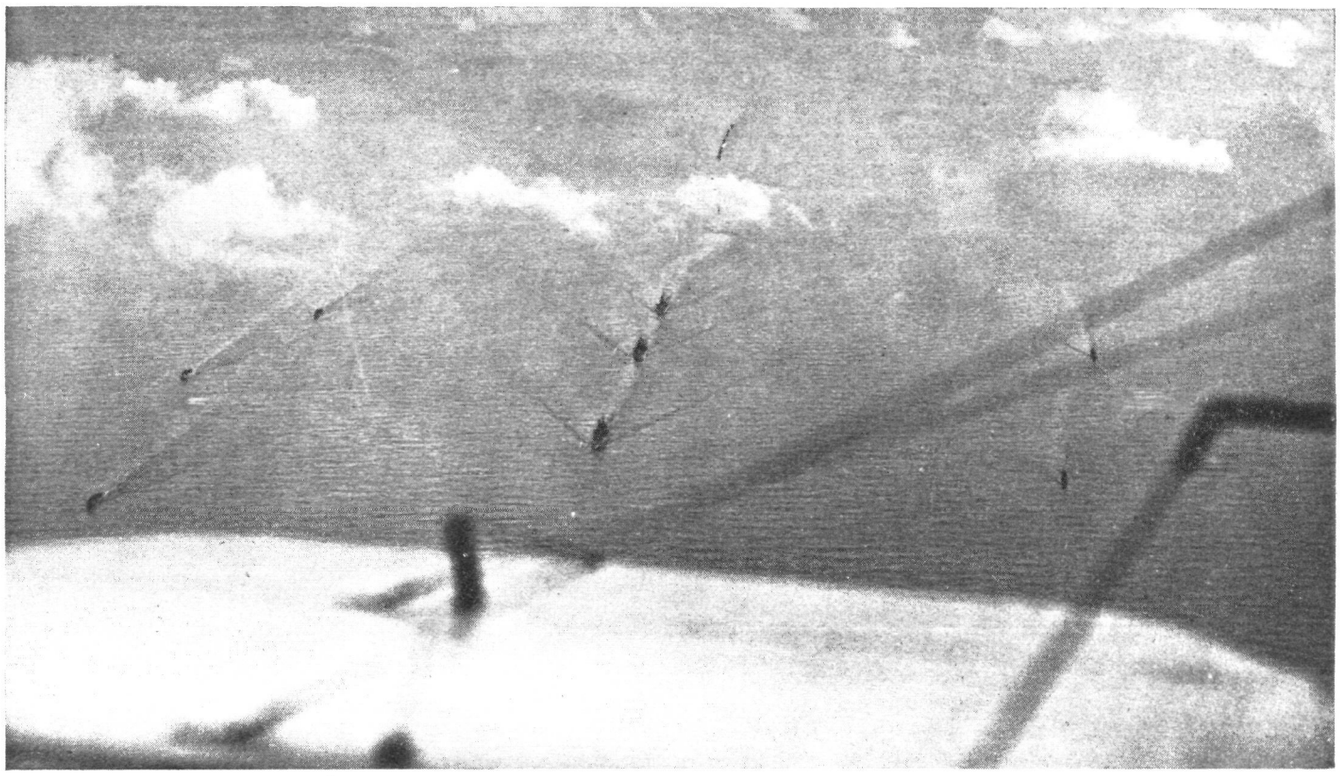


GULLANE : An old aerodrome near the charming golfing town of Gullane was used as a fuelling station by the two squadrons of Hawker "Harts." (FLIGHT *Photo.*)



THE HAWKER "AUDAX" (Rolls-Royce "Kestrel"). A machine possessing all the qualities required for Army Co-operation work. Accurate manœuvrability through the whole speed range, a good climb and a high top speed.

"Flight" Photo.



THE MAIN FLEET : H.M.S. *Renown*, *Warspite* **and** *Malaya* **in line ahead, with attendant destroyers, as seen from a Blue aircraft.** (FLIGHT *Photo.*)

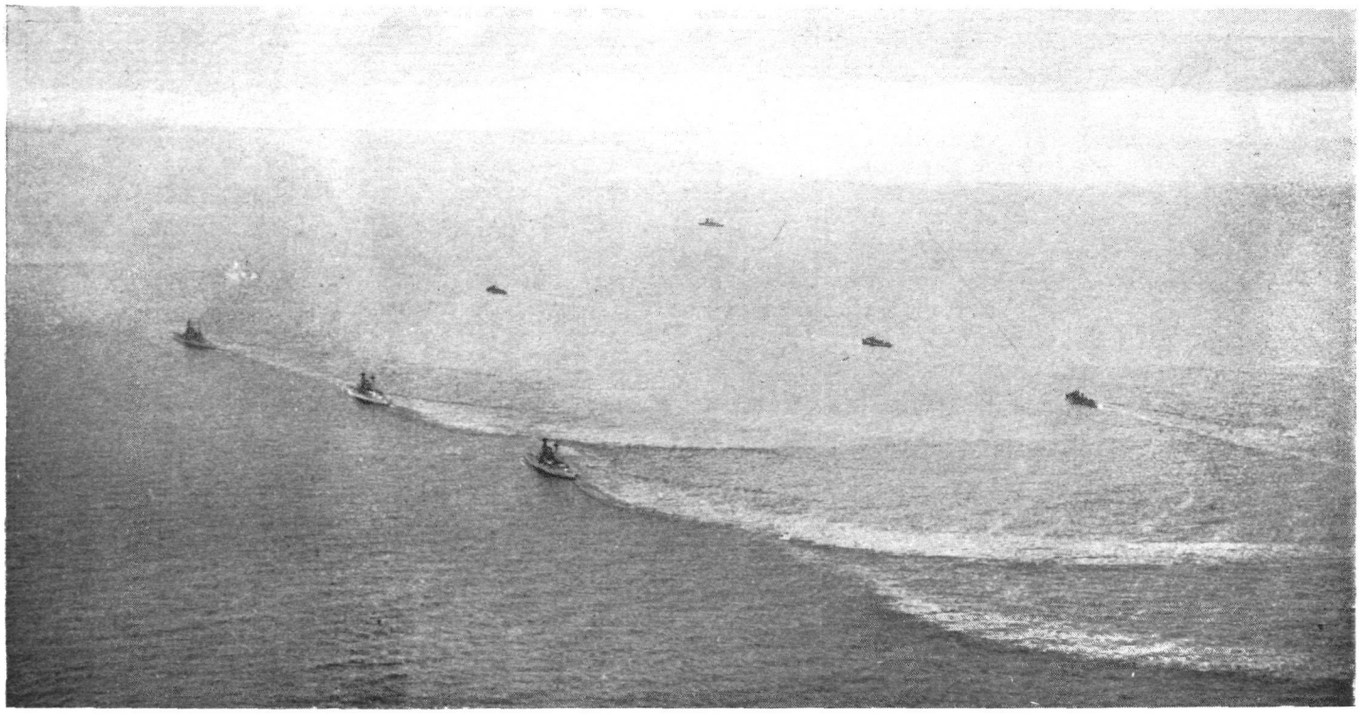
pilot disregarded the possibility that we might have been shot down, and continued to shadow the carriers. As the afternoon wore on flocks of small fleecy clouds came up, and sometimes we flew over them, and could only see through the gaps between them. As the sun got lower the colour of the sea changed, and everything grew even more beautiful than it had been before. At times we saw tiny little aircraft down below us, which seemed to be crawling on the surface of the water. They must have been Red machines returning to the carriers. About 18.45 hours the wake and the bow-wave of *Furious* and her destroyer disappeared from sight. She had hove to. *Courageous* was hastening away towards the north. It was time for us to be returning home. We headed straight into a lurid red sunset. Lights came out all along the shores of the Forth, and there ahead of us was the Forth Bridge, with lights on it to guide us. We flew over it, and landed off Port Edgar, practically in the dark. Our flight lieutenant climbed down from his seat, and remarked to me, "Seven hours fifty minutes in one position is quite enough." I feel quite sure that he was right.

When we got on to the pinnace we learnt that all the Red fleet had been located by the boats, but that one "Southampton" had been forced to land about 100 miles out to sea and was being towed in by a destroyer. It had on board Maj. Oliver Stewart, of the *Morning Post*. They got to Port Edgar at 11.30 hours next day. It cannot have been an enjoyable experience.

We also learnt that Port Edgar had been bombed by six Red aircraft while we were away. Only four flying boats were at their moorings, and they cannot have presented a large target. Nor can it be exactly easy to hit a long straight line like the Forth Bridge from any height. That was the only serious raid made on shore bases by the Red aircraft that day. Several single machines had been sent to reconnoitre the Blue bases, and had spotted practically all of them. Some of these Red machines were chased out to sea by the patrolling "Harts," but most of them had signalled by red lights that they had dropped bombs before they were intercepted. No doubt they also sent off their reports without delay.

On the whole, the main credit of the day must go to the flying boats, and especially to S.1229. Granted that the weather and the conditions made their task comparatively easy, they did what they were sent out to do, and, apart from the forced landing, they could not have done better than they did.

AT LEUCHARS : The Boulton & Paul "Sidestrands" (two "Jupiters") of No. 101 (Bomber) Squadron in readiness for a raid.



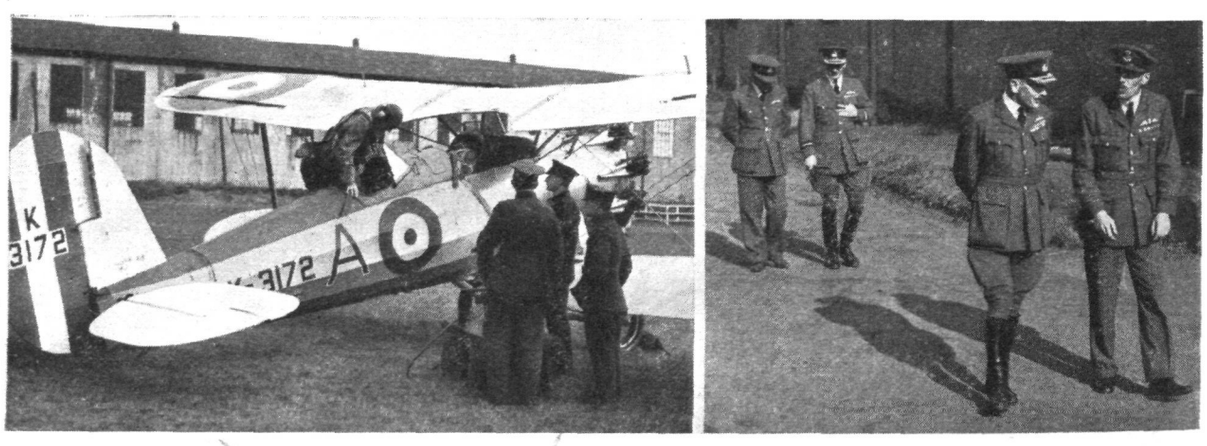
TELL-TALE WAKES: The three capital ships changing course and formation as a Blue bomber squadron approaches. Their attendant destroyers are beyond, and farthest away is a cruiser. (FLIGHT *Photo.*)

Saturday's Operations

The war began again at dawn next day. Soon after 05.00 hours six flying boats took off from Port Edgar. There was ground mist at Turnhouse, a few miles west of Edinburgh, which put that aerodrome out of action for a while and kept Nos. 602, 603, and 33 (Bomber) Squadrons aground until 09.00. The boats soon found the Fleet again, about 50 miles off Elie, and sent in their reports. On receipt of them the Blue Commander ordered his bombers to attack the Fleet. The "Sidestrands" of No. 101 B.S. made the first attack, dropping their bombs on the three capital ships *Warspite, Malaya,* and *Renown*. The carriers worked apart from these three, and the Blue attacks were mainly concentrated on the three above-mentioned. No. 101 delivered their attack at 09.00. Then No. 811 T.B.S. delivered a torpedo attack on the same three ships, and subsequent attacks were delivered by Nos. 40 ("Gordons"), 12 ("Harts"), and 603 ("Wapitis"). The three cruisers, who were not far from the capital ships, also received attention from the bombers. In all a total of 19 raids on the Fleet was made by the bombers. No Blue squadron carried out less than two raids, three squadrons carried out three raids each, and one squadron carried out four. At the end of each raid the squadron would return to its aerodrome to refuel and re-arm. One raid by No. 12 B.S. from Gullane only occupied 11 min., as the Fleet had then reached a bombarding position a few miles east of May Island. The two commanders agreed to end the exercise at 13.00 hours.

The conclusion reached at Blue H.Q. was that during the early part of the operations that day the Red Commander sent only a few of his aircraft to reconnoitre and used the bulk of them for the protection of his ships. The Blue bombers and flying boats were frequently attacked by Red fighters. Soon after 11.00 hours, however, bombing attacks on shore bases began. Five Red machines bombed the aerodrome at Montrose, and another formation of five made an attack on Leuchars. The Blue Commander had prepared a dummy aerodrome near Leuchars with training aircraft drawn up on it, and this ruse was successful. The dummy received the brunt of the attack, and the base of No. 101 B.S. and the H.Q. were left intact.

It would be wildly premature to attempt to draw conclusions from these exercises, and the wildest remark made by anyone was to the effect that the Fleet would have been sunk by the bombers. Every bullet does not find its billet, nor does every bomb. The Fleet was steaming slowly, and was not making an intensive use of its own aircraft. Still, the Air Force authorities feel that useful lessons have been learnt as to the training and equipment needed for the air defence of a land base against a fleet which includes carriers. For my own part, I was much impressed by the value of flying boats for long reconnaissance, and am confirmed in my opinion that the number of flying-boat squadrons in Home waters ought to be multiplied by X.



THE C.-IN-C.: Air Marshal Sir Robert Brooke-Popham, K.C.B., etc., flew round the Blue aerodromes in a two-seater "Bulldog." The picture on the right shows Sir Robert walking with Wing Com. L. T. N. Gould, M.C., followed by his Senior Staff Officer, Air Commodore E. L. Gossage, D.S.O., M.C., talking to Sqd. Ldr. Murray-Philipson, M.P. (FLIGHT *Photos.*)

From the Clubs.

THE COTSWOLD AERO CLUB

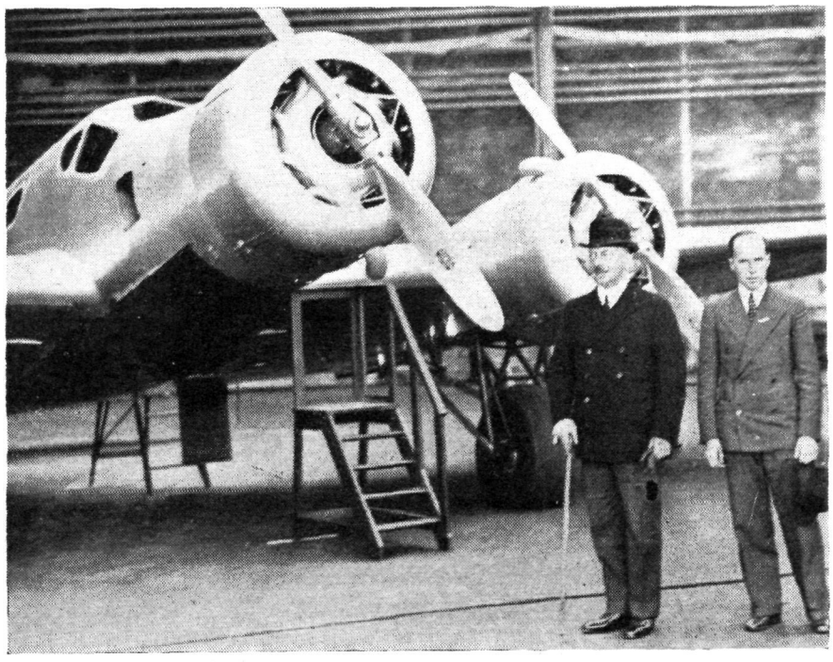
The Cotswold Aero Club held their annual rally and garden party at their Staverton Aerodrome on the Cheltenham-Gloucester Road, on Saturday, September 23. Unfortunately for them the weather broke, and the meeting was "washed out" with a vengeance. Only two visiting aeroplanes arrived during the afternoon. The first was a Bristol Fighter which had been flown from Hanworth by Mr. H. P. Sears, who has recently taken an instructor's course at the A.S.T. School, Hamble, and the second, a "Dragon" belonging to the Vacuum Oil Co., Ltd. This latter carried Mr. Gordon England and Mr. Faust, prominent officials of the company, and Mrs. Gordon England, and was flown from Hanworth by Mr. H. White. The weather was very thick indeed, with low cloud and heavy rain, and Mr. White found the inside of the "Dragon" cabin infinitely preferable to the cockpit of an open machine; moreover, having two "Gipsy Major" engines enabled him to fly low when necessary with a feeling of confidence. The company have only had this machine a short while, but have already made extensive tours in Europe.

The Staverton Aerodrome is really only a temporary one until such time as the municipal aerodrome, over which negotiations are now in progress, is completed. This is situated close to the present aerodrome and will serve both Gloucester and Cheltenham. At the present time instruction is given at a larger aerodrome run by the club at Cirencester. They boast 105 members with 20 "A" licences among them, seven of which have been gained since they started flying in March this year. The Mayor of Gloucester (Ald. W. L. Edwardes) and the Mayor of Cheltenham (Capt. J. H. Trye, R.N.), together with their Town Clerks, were present, but were only able to be entertained with a very abbreviated programme. This was most ably commented on by Mr. R. Ashley Hall, who nobly sat on a chimney pot under cover of an umbrella throughout the whole afternoon. His work with the microphone was the bright spot of the afternoon.

OPENING OF AMSTERDAM AERO CLUB'S NEW CLUBHOUSE

The new club-house of the Amsterdam Aero Club was officially opened by the Prince Consort, H.R.H. Prince Henry, on Saturday, September 23. This event gained added interest from the fact that two of the latest Dutch machines were on view. Promptly at 3 p.m. the Royal car drew up at the club-house, where Mr. Ernst Crone, President of the Club, supported by a large assembly representative of all branches of Dutch aviation, waited to receive the Prince. A short speech of welcome was made by Mr. Crone, who was followed by Baron Krayenhoff, speaking in the name of the Tourist Club A.N.W.B., and by Dr. Abrahams on behalf of the municipality. After a few more speeches had been made, Prince Henry pulled the red, white, and blue cord, which broke out the Club flag over the building, and the whole company joined in the singing of the "Wilhelmus", then three cheers were given for the Queen and the Prince Consort.

A display of flying was then given. Three instructors from the Royal School of Aviation formated, a gliding demonstration was given by the Dutch expert, Van Neyenhoff, and an excellent display of aerobatics by the English aviator, Mr. Thorn, of Brooklands Club, in a "Tiger Moth." This latter event drew loud applause from the spectators. Later Mr. A. Fokker took Prince Henry and a select party up in the new Fokker F.XX, the "Zilvermeeuw." This was the first public appearance of this machine, which will be put into operation on airlines by the K.L.M. early next year. It is powered by three Wright "Cyclone" engines, each of which develops 650 h.p., giving a cruising speed of 150 m.p.h.; the machine is also fitted with a retractable undercarriage. Another attraction was the Pander "Postjager," which is shortly to set out on a four and a-half days' speed flight to the East Indies. This was the first public appearance of this machine also. Mr. Slot, the designer, and Mr. Geysendorffer, who will, with Lt. Asjes, pilot the machine, were also present to explain the features to the crowds which thronged about it. Alongside the "Postjager" stood the "Pelikaan," one of the machines which makes the weekly 9,000-mile flight to Batavia. Altogether a very happy and successful day, which augurs well for the future prosperity of the Amsterdam Club.



Prince Henry of the Netherlands (extreme left) in front of the Pander "Postjager" on the occasion of the opening of the new clubhouse of the Amsterdam Aero Club. On Prince Henry's left is Mr. Pander, Jr.

HANWORTH (N.F.S.)

Flying time for the week totalled 75 hr., which included first solos by Mr. Falk and Mr. Weston, the latter being the *Daily Express* pupil. Cross-country flights included those by Messrs. Kirwan and Hutton to Bournemouth, Mr. Ramsay to Lympne and Com. Whiteley to Shoreham. On Friday, September 22, Lord Carlow flew to Croydon and Mr. Fitzwilliam put in 2 hr. Several trial lessons were given to visitors during the week. Among the interesting taxi trips was one by a member of the staff of a monthly magazine to acquire material for an article, and another by a representative of Fox Photos, Ltd., who flew to Southampton to take photos of the *Empress of Britain*, which had Mr. Scott-Paine on board. On Wednesday, September 20, Flt. Lt. Wilson and Mr. Harris flew to Battle, Sussex, to attend the funeral of Capt. Pennington. Applications for the dance which is to be held on Friday, September 29, should be sent in at once, as the list is closing shortly.

READING AERO CLUB

Winds and rain interfered with flying during the past week, only 31 hr. 10 min. being recorded, with 14 pupils under instruction and four machines serviceable. One "A" licence was obtained, by Mr. J. A. Rooper. Mr. and Mrs. Miles have returned from their "Hawking" holiday; during the 20 hr. flown the machine gave no trouble, and it was flown by many pilots on the Continent. Dr. Mintzman has taken delivery of his "Hawk."

BROOKLANDS

The School's flying times for the week totalled 60 hr. dual and 65 hr. solo. New members include Messrs. J. P. Coombe, Appleton, Roy, Ramchandari and G. Davies.

Ten machines from the Club took part in the last "Dawn Patrol," Reading being the defending aerodrome; the only machine to get through was that piloted by Mr. G. Lowdell. Much interest has been aroused by frequent visits of the Airspeed "Courier" which is being demonstrated by Mr. Naish. Brooklands Airways are doing a steady business, one of their passengers being Mr. Fothringham, the motor racing driver, who was flown over to Germany. Mr. Thorn, the Sales Manager, has been over in Amsterdam demonstrating the "Tiger Moth." Several private members of the Club flew over to Amsterdam on the occasion of the opening of that town's Aero Club; among them were Messrs. Ahlers, Mendl, Telders and A. W. Fairlie.

DE HAVILLAND SCHOOL OF FLYING

The number of hours flown during the week was 90. The Club have to congratulate Mr. Robert Douglas, a member of the cast of "Ten Minute Alibi," on obtaining his "A" licence. The Stage and Screen Sporting and Aero Club Theatrical Garden Party, which has been organised by Maj. Graves and Mr. J. Raglan, will take place on Friday, September 29.

LONDON AEROPLANE CLUB

The house warming, which was held on Saturday, September 23, was a great success, many members gathering to greet their new instructors. As a result of the move there was very little flying over the week-end, though on Sunday the machines were kept busy all the day long. The machines of the Technical School have been added to the Club, making a total of six in all.

CARDIFF AEROPLANE CLUB

The flying times for the week ending Sunday, September 24, totalled 9 hr. 45 min. dual, 5 hr. 10 min. solo, and 30 min. tests. One new flying member, Mr. H. G. Lewis, has joined the Club.

NEWCASTLE-UPON-TYNE AERO CLUB

The Newcastle Aero Club will be closed from Saturday evening, September 30, to Saturday evening, October 14, for the staff holiday. During this time the machines are being sent to Brooklands for the renewal of their C's. of A., therefore there will be no solo or instructional flying during this period; the aerodrome will be open, however, from 10 a.m. until dusk each day for the conveniehce of visiting pilots.

MAIDSTONE AERO CLUB

The Maidstone Aero Club will hold their first monthly "At Home" of the autumn on Sunday, October 1, and all those interested will be welcome. In the afternoon there will be a motor cycle and car gymkhana, to be followed in the evening by a special gala dance.

KENT FLYING CLUB

Flying times for the week ending September 24 totalled 20 hr., new pupils being Dr. Fraser and Mr. Doyle. Miss Joan Ramsay, aged 16, has done her first solo; she is the fourth member of the family to learn to fly. Mr. Ramsay still continues to fly both a "Moth" and an "Autogiro," although he is 71 years of age. A general meeting of members was held on September 24, when it was decided to reduce the flying membership subscription from £3 3s. a year to £1 1s. a year.

SKEGNESS AND EAST LINCOLNSHIRE AERO CLUB

Although joy-riding figures have fallen off considerably during the last three weeks, a considerable amount of taxi work has been done both in the "Fox Moth" and "Puss Moth," flights being done to the Isle of Man, Darlington, Saltburn, Taunton, Edinburgh, Liverpool, and London. Mr. Kenwick has joined the Club as a flying member, and Mr. Broughton has done his first solo. Two members of the Club competed in the "Journal Cup" competition, but were among the "also rans"; they were Messrs. Townsend and Henshaw; the former has now completed 100 hr. flying necessary for a "B" licence, and is shortly taking his tests.

NORFOLK AND NORWICH AERO CLUB

The week ending September 16 provided favourable weather, and 30 hr. flying was done, two pupils, Miss V. Inglis and Mr. W. G. Watson, passing tests for "A" licences. Instruction was given by Mr. Collier to Mrs. H. Sparks, Miss V. Inglis, Messrs. W. G. Watson, F. W. Rushmer, J. B. Purefoy, H. Wilson, and P. Britton. Solo flights were done by Misses W. F. Hudd, V. Inglis, F. Henfrey, Messrs. H. Birchall, A. Kirkby, H. C. Stringer, P. M. Britton, F. Dawson Paul, W. G. Watson, J. B. Purefoy, S. Hansel, E. V. Goodhill, F. Rainbow, A. A. Rice, and A. J. Morris. Mr. S. Hansel took a machine away to Leeds for the week-end. Visitors to the Club during the week included Dr. Gregory in a "Gipsy III Moth" from Heston, Capt. A. N. Diamant in a "Puss Moth" from Sywell, Mr. and Mrs. Arch, Miss Dodo Watts, Messrs. Jack Hobbs and Woods, in a Fokker from Surrey, and Mr. R. Russell in a "Moth" from Hanworth.

The following received instruction from Mr. J. Collier last week:—Messrs. P. Britton, J. Purefoy, H. Wilson, F. W. Rushmer, J. C. Smith and Miss N. Deacon. Soloists were:—Capt. J. D. Paul, Messrs. S. Hansel, H. C. Stringer, A. R. Kirkby, J. B. Purefoy, A. J. Morris, E. V. Goodhill and Miss W. F. Hudd. Mr. H. C. Thompson, of Snettisham, who has joined the Club, received some refresher instruction.

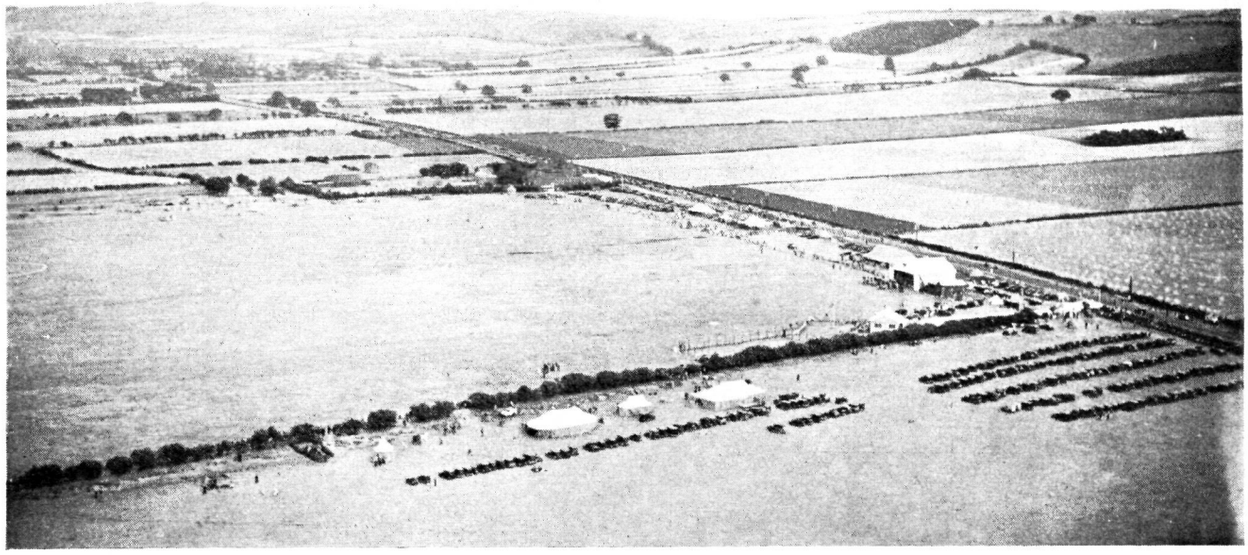
Visitors to the Club last week were Mr. and Mrs. Turner in an Avro "Cadet" from Heston, Mr. and Mrs. H. Deterding in a "Fox Moth" from Daventry, Mr. Wright from Castle Bromwich in a "Puss Moth," Mr. Smith-Barry, also in a "Puss Moth," from Heston, Mr. M. D. L. Scott and Miss Patterson from Heston ("Puss Moth").

Another dance will be held in the clubhouse on Wednesday, October 11, for which tickets may be obtained from the Secretary at 3s. 6d. each. The Club's Annual Ball will be held at the Thatched Assembly Rooms on Friday, November 3, Fred Anderson's Park Lane band having been engaged for the evening.

LINCOLNSHIRE AERO CLUB

Hours flown during the week totalled 38, with 14 pupils under instruction. The number of passengers carried on the Humber Air Ferry during the week was 145. On

A BRITISH SUCCESS IN POLAND: This R.W.D.5 machine, fitted with a "Hermes IV" and piloted by M. Pronaszko, obtained first place in the Fifth Round Poland Flight which took place on September 2-10.



An aerial view of the Scarborough Aero Club's aerodrome at Ganton. (FLIGHT *Photo.*)

Thursday, September 21, Sir Alan Cobham's National Aviation Day Display visited the aerodrome.

NEW ZEALAND CLUBS

At a meeting of members of the Tauranga, Matmata and Whakatane Aero Clubs, which was held at Tauranga, a deputation from the Auckland Aero Club, consisting of Messrs. W. A. Boucher (President), J. D. Swann (Secretary), and Flt. Lt. Allen (Instructor), was present. The purpose of the meeting was to endeavour to arrange for the Auckland Club to carry on tuition and flying practice at Tauranga and in adjoining centres. Mr. Swann emphasised the importance of clubs to aviation in general. The Auckland Club felt justified in assisting other clubs though no financial profit could be expected. After discussion, the clubs represented agreed on negotiations being concluded on the lines suggested.

CIVIL FLYING IN LAHORE

The visit of the Deputy Director of Civil Aviation to Lahore is reported to have given the inhabitants of that place who are interested in aviation an opportunity of discussing plans for the renewal of flying in the district. Lahore will probably possess a flying club early in October.

AERO CLUB OF SOUTH AFRICA

It may interest readers of FLIGHT to know that the Aero Club of South Africa no longer exists. The headquarters of the Club were transferred to Johannesburg from Cape Town some years ago, and it has since been allowed to lapse. Efforts made to revive the club failed to produce any response, and it can, therefore, be assumed that it is now dead. All private flying in Cape Town is centred at the aerodrome of Aero Services, Ltd., Wynberg, Cape Town, to whom inquiries should be made on matters aeronautical.

DEATH OF MAJOR COCHRAN-PATRICK, D.S.O., M.C.

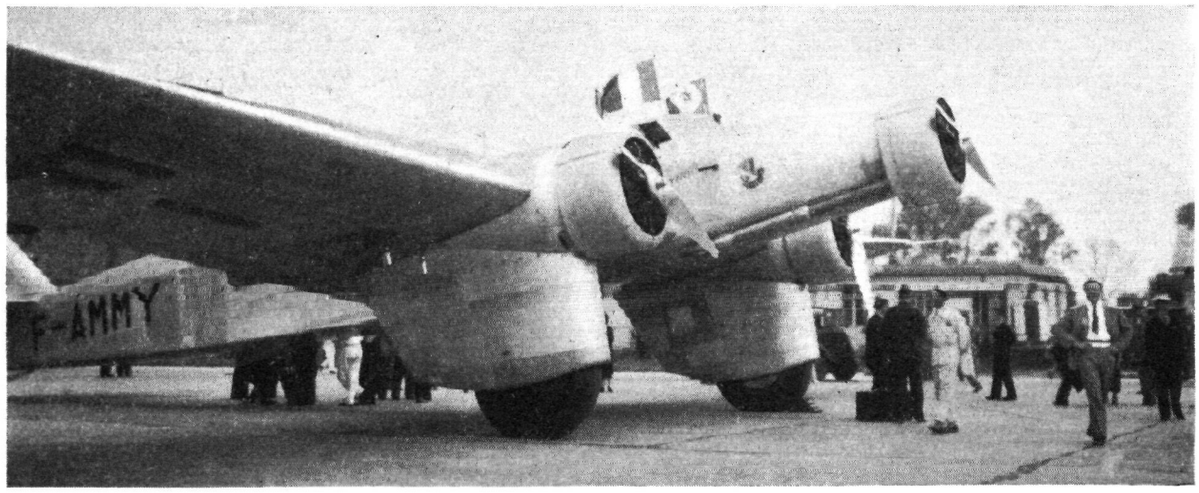
WE very much regret to hear of the death in an air crash of Maj. Charles Kennedy Cochran-Patrick, D.S.O., M.C., F.R.G.S., A.F.R.Ae.S., at Baragwanatti, Johannesburg. According to the information available at the moment of going to press, Maj. Patrick was taking off in a special "Dragon" which had been fitted out for survey work, with Sir Michael Oppenheimer, Bart., as passenger The aerodrome is at a height of 6,000 ft. above sea-level, a fact which this very skilful and careful pilot may have forgotten for a moment. He is said to have stalled in a vertical turn near the ground, and both he and his passenger were killed. Among the many pilots whom we have known we should have thought none more unlikely to take any sort of needless risk than Maj. Cochran-Patrick.

In the early days of the war Maj. Cochran-Patrick was one of the first pilots to make a name for skill in air fighting and in general flying. At the moment we cannot say how many enemy aircraft he shot down, but the present writer has heard him speak of something happening" on the day when my 13th Hun was confirmed." Most of his fighting was done in Spads. At the end of the war he went to the Air Ministry to take charge of air fighting training. Then he returned to civil life, and for a short time joined A. V. Roe & Co., Ltd. Then he took charge of an expedition to Venezuela to search from the air for oil deposits. While in South America he discovered from the air a hitherto unknown mountain right in the path of a proposed road through the forest, and so saved much money to the Government of British Guiana, who named the mountain Mount Patrick after him. The experience which he gained during this expedition determined the rest of his career. He devoted himself to air survey and photography. Acting for the Air Survey Co. he carried out the survey of the delta of the Irrawadi river in Burma. Then he joined the Aircraft Operating Co., and took charge of surveys in Brazil, Iraq, Northern Rhodesia, and elsewhere.

Maj. Cochran-Patrick was one of the most charming men one could wish to meet, and his manner was so gentle that it was hard to realise that he had been one of our most doughty air fighters. Careful and thoughtful in all that he did, one would have thought that he of all men would never die in an aeroplane crash.

I.A.T.A.

THE Marquess of Londonderry, Secretary of State for Air, opened the session of the International Air Traffic Association yesterday, Wednesday, September 27. In welcoming the delegates, the Air Minister paid a tribute to the memory of the late Sir Sefton Brancker and the late Mr. Holt Thomas, as well as to the director-general of I.A.T.A., Jonkheer van den Berch van Heemstede. He said that the traveller who today takes a ticket at Croydon for Constantinople very seldom realises how much he owes to the I.A.T.A. for the ease and smoothness of his journey. Lord Londonderry went on to say that the aeroplane was destined to be the most potent instrument of peace among the nations, and he strongly contradicted the idea that it should be regarded mainly as an instrument of war.



THE FLIGHT TO MOSCOW : The new Dewoitine D.332 monoplane just before leaving Le Bourget for Moscow, with M. Pierre Cot, Air Minister, on board.

THE FRENCH AIR MINISTER'S TOUR

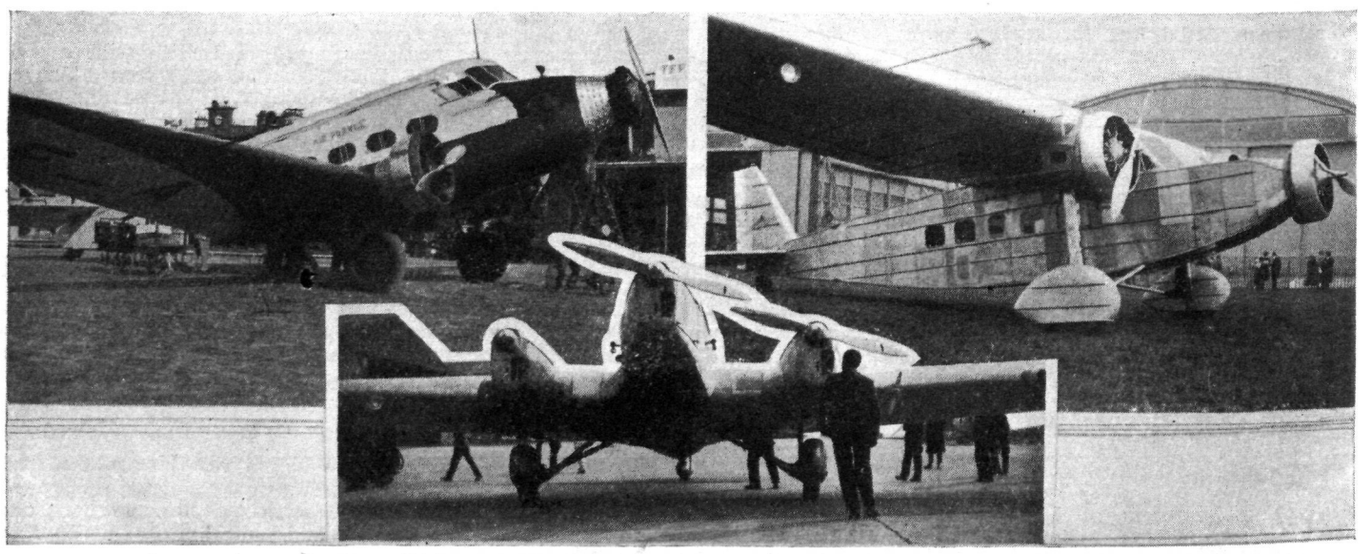
WE have already referred, briefly, to the "show-the-Flag" air tour to Russia undertaken by the very active French Air Minister, M. Pierre Cot. We are now able to give our readers a few more details of this Propaganda flight, which may be of interest.

The group of French transport planes of the latest and fastest types, with the Air Minister and a number of high aviation officials on board, left the Paris District on September 12 for Moscow, making several intermediate stops on the way. This squadron was composed of the new Dewoitine D.332, the Wibault-Penhoet 282 T. and the Marcel Bloch type 120, all three-engine machines of metal construction throughout. They took off at different times during the day, the Marcel Bloch leaving from Villacoublay, the two others from Le Bourget.

The Marcel Bloch was the first to take off. It was piloted by Chief Adjutant Raynaud, of the 34th Aviation Regiment, with Capt. Dasque, of the Service Technique, as his assistant, and also carried a radio operator and four mechanics. The plane left Villacoublay at 10.50 a.m. for Lwow, Poland, via Prague, where it was joined by the other two machines on the following day. The Wibault machine took off from the Le Bourget apron at 11.17 a.m., piloted by Gaston Durmon, the chief pilot of the C.I.D.N.A. system, with Capt. Terrasson, of the Service Technique, as assistant pilot, and a radio operator and mechanic. The passengers comprised a distinguished group composed of MM. Albert Caquot, Directeur-General of the Service Technique, Emmanuel Chaumie, Directeur of Commercial Aviation and Dekayser, Capt. Alamichel and Lt. Noel, of the Air Minister's Staff. The Wibault plane followed the Marcel Bloch to Lwow, where they met the Dewoitine plane with the Air Minister and his party aboard, the next day.

M. Pierre Cot, the Air Minister himself, boarded the new Dewoitine plane, piloted by Marcel Doret, at the Le Bourget apron at 3.35 p.m. Tuesday afternoon, and, without any accompanying ceremony, took off for Strasbourg as his first stop, where he reviewed the 2nd Aviation Regiment. The Minister and his party left Strasbourg early Wednesday morning for Lwow, whence, in company with the two other planes, who met them there, they flew to Moscow, via Kiew and Kharkoff, arriving at the Russian capital on Friday, September 15, at 2.30 p.m. The Ministerial party were received on landing by leading Soviet officials, including M. Maxim Litvinoff, the Minister of Foreign Affairs, and the heads of the Air Force. Numerous functions were given in their honour, and inspections made of the various aviation installations and material.

Two other planes also left Paris the following day to join the Ministerial group in a semi-official capacity. The Blériot machine, *Joseph Le Brix*, piloted by Maurice Rossi and Paul Codos, the new long-distance record holders, and the three-engine Couzinet plane, the *Biarritz*, piloted by Charles de Vernheilh, who has also made a number of long-distance flights, took off from Le Bourget Wednesday morning about 8 o'clock at an interval of an hour apart. M. Pierre Cot arrived back in Le Bourget on September 22.



FLYING SAMPLES : Three of the French commercial aircraft which were flown to Moscow to show the Russians what France can produce in this way. Top, left, the Wibault-Penhoet 282T. ; right, the new Marcel Bloch 120 and, below, C. de Vernheilh's Couzinet monoplane *Biarritz*.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

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CONTENTS

THE CENTRE OF GRAVITY POSITION OF AN AUTOGIRO

By J. H. Crowe, M.Sc., A.F.R.Ae.S.

The problem of the Autogiro at large angles of incidence is mainly one of stability and control. In this respect it is similar to the Helicopter. It has been amply demonstrated that a screw can be designed which will give the necessary lifting power to take a machine up vertically. There remains the problem of producing equilibrium between the forces involved when there is no air stream, apart from the induced velocity of the rotating blades, in which to operate a control.

The question of whether an Autogiro can land truly vertically can only be settled by a consideration of the stability and control of the machine involving as this does a discussion on C.G. position. The aircraft must be balanced at all possible angles of incidence when we can see what degree of control is required to hold the aircraft at any particular gliding angle. Also from our tail setting curves or overall moment curves we shall see the degree of longitudinal static stability for different C.G. positions. This latter should give us possible C.G. positions, since an aircraft that has inherent static instability at steep angles of glide is obviously inadmissible, and, knowing the possible C.G. positions, we should be able to arrive at possible gliding angles. That the C.G. positions affects the possible gliding angle will be apparent later on.

There is always, of course, the psychological aspect of vertical descent. It is quite likely that descent at 45 deg. to the horizontal looks to be, at any rate if not vertical, nearer vertical than 45 deg., since we are not accustomed to aircraft descending at such steep angles. The small run on landing (the forward velocity at a gliding angle of 45 deg. is about 16 m.p.h.) considerably aids the imagination in picturing vertical descent. This is an aspect of the problem that need not concern us.

There are three possible positions for the C.G. of an Autogiro; it may be forward of the vertical shaft, directly beneath it or behind it. Take first of all a very elementary consideration of the balance of the machine descending vertically. Since the axial induced velocity will be something less than the vertical velocity, the resultant air velocity acts upward; there is therefore a positive lift on the tailplane. It is obvious, therefore, that the C.G. cannot be in front of the vertical shaft, since the only other forces acting are the weight acting through the C.G. and the drag of the blades acting vertically upwards through the shaft; the aircraft cannot be in equilibrium. At a vertical velocity of 30 f.p.s., which would appear to be about the minimum speed at which an Autogiro descends vertically, assuming that it can so descend, the drag of the tailplane, allowing an air speed equal to the speed of vertical descent minus the axial induced velocity, can only be of the order of a few pounds. Neglecting any moment due to the body therefore, the only possible C.G. position is a fraction of an inch behind the vertical shaft. It will be shown later on that the aircraft is definitely unstable with the C.G. under or behind the vertical shaft. The degree of instability rises as the incidence increases. There is also the fact that since the air speed over the tail would be of the order of 10 f.p.s., even with an all-moving tailplane with 90 deg. movement the amount of control available in this attitude is practically negligible.

It would appear, therefore, that an Autogiro cannot descend truly vertically in still air. That the actual gliding angle possible depends on C.G. position is easily demonstrated. Consider the aircraft descending on an even keel with the C.G. a few inches in front of the shaft. The thrust of the Autogiro acts vertically upwards, and will produce an anti-clockwise moment about the C.G. requiring a negative lift on the tailplane to balance. As the incidence increases so the elevator will have to be held more negative until all the control, on both tailplane and elevator, is used up. This determines the maximum gliding angle. If we let the C.G. move further back less negative lift will be required on the tailplane, hence for the same negative setting the incidence, and therefore the gliding angle, can be greater.

We can therefore secure a steeper gliding angle by putting the C.G. further aft, but we are limited as to the backward travel of the C.G. from a point of

view of stability. If we are to achieve steep gliding angles, even with a large possible value of negative tail range, the possible travel of the C.G. is very slight. At such large angles of incidence as the Autogiro operates at, the stability of the machine will be found to be very sensitive to changes in C.G. position. The best position will obviously depend on the characteristics of the particular aircraft.

The characteristics of an Autogiro on which the following calculations are based have been taken from R. & M. 1111. These depend on the values of three fundamental parameters, σ the solidity defined as $\frac{Bc}{\pi R}$ where B = number of blades, c = chord and R = radius, θ the angle of pitch of the blades and δ the mean profile drag coefficient. In order to save unnecessary calculations these have been assumed to have the values σ = 0.2, θ = 2 deg. and δ = 0.006, and the characteristics have been taken from Table 4 of that report. The angle of incidence of the rotor is i, defined as the angle that the shaft of the Autogiro is inclined backwards to the normal to the direction of motion. K_Z and K_X are coefficients based on disc area such that

$$\left.\begin{aligned} \text{Lift} = Z &= K_Z \pi R^2 \rho V^2 \\ \text{and Drag} = X &= K_X \pi R^2 \rho V^2 \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

Calling the gliding angle of the aircraft ϕ, by equating forces normal to and along the flight path, we have

$$\left.\begin{aligned} W \cos \phi &= Z \\ W \sin \phi &= R \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

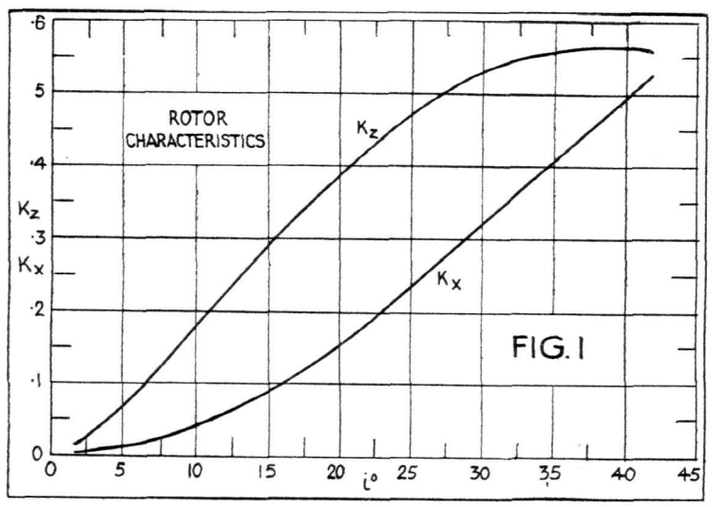
where $R = (K_X + K_B)\pi R^2 \rho V^2$. Equations (2) give us the usual gliding flight equations—

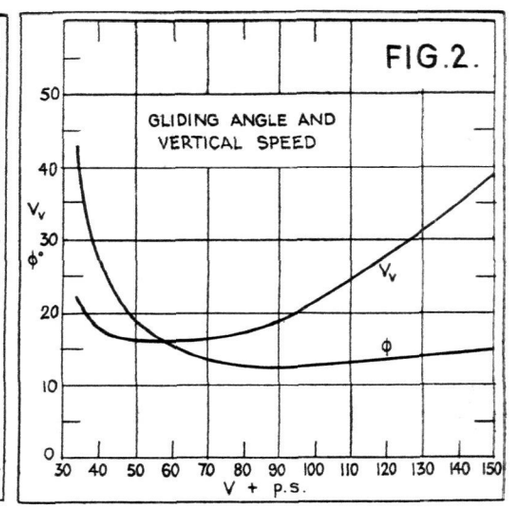
$$\left.\begin{aligned} \text{Tan } \phi &= \frac{R}{Z} \\ V^2 &= \frac{W}{\rho \pi R^2 \sqrt{K_Z^2 + (K_X + K_B)^2}} \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

The components of this velocity are—

$$\left.\begin{aligned} \text{Horizontal } V_H &= V \cos \phi \\ \text{Vertical } V_V &= V \sin \phi \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (4)$$

Using the above equations and the data already given, the curves of Fig. 2 have been prepared which show ϕ and V_v plotted against V. The curves are very similar to those that would be obtained for a normal aircraft except, of course, that they go down to much lower speeds. The minimum V_v is 16 ft. per sec. and the minimum ϕ is 13 deg. occurring at speeds of 55 ft. per sec. and 90 ft. per sec. respectively. As the speed decreases below 55 ft. per sec. the vertical velocity rises slowly, but the gliding angle rises quite rapidly.





The characteristics taken are plotted in Fig. 1. The maximum value of i to which the table goes is 41.5 deg. which will be just about sufficient for the purpose. In the particular machine considered this corresponds to a gliding angle of 43 deg.

Five different C.G. positions have been assumed. If the C.G. position is denoted by x with reference to the vertical shaft, positive when the C.G. is in front of the shaft, then x has been given the values 0.5, 0.25, 0, −0.25 and −0.5 ft. It is assumed that the C.G. moves normal to the rotor axis. In addition, the following data have been assumed for the Autogiro: R = 17.5 and W = 1930 (such that $\frac{W}{\pi R^2} = 2$, a normal loading for these machines) tail area S_T = 30 sq. ft., tail arm l = 15 ft., with C.G. at x = 0, vertical distance from pivot of blades to C.G. a = 6 ft., parasite drag coefficient, including air screw, K_B = 0.0035 (based on disc area as for K_X).

Having the characteristics of the rotor and the above data for the aircraft, the balance of an Autogiro presents no difficulties whatsoever; it is, in fact, a simpler process than the balance of a normal aircraft, since the Autogiro has no shift of centre of pressure. One point of difference arises, of course, and that is in the calculation of downwash; this will be dealt with later on. The equations of gliding flight are put down here for the purpose of defining the symbols used.

Thus at a vertical velocity of 20 ft. per sec. the gliding angle is 34 deg. as against 17 deg., with a vertical velocity of 16 ft. per sec. It would appear that for $V_v = V$, that is, for vertical descent, the curve is tending towards 30 ft. per sec. unless it bends back, in which case it may be higher than this figure. In R. & M. 1111 Glauert states that for an Autogiro with this loading the velocity of vertical descent would be between 30 and 35 ft. per sec. However, what happens to the curves after a gliding angle of 45 deg. is reached need not concern us, as it is very improbable that this figure has been exceeded in still air. It is improbable, indeed, that the maximum-lift coefficient at 40 deg. incidence has been very much exceeded, since the descent of an Autogiro must become more rapid after this figure is reached.

For the moments about the C.G., referring to Fig. 3, if x is the distance of the C.G. in front of the vertical shaft, we have

$$\left.\begin{aligned} Z_M &= -Z(x \cos i + a \sin i) \\ X_M &= X(a \cos i - x \sin i) \end{aligned}\right\} \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

where the suffixes M stand for moments. In order to obtain coefficients we propose to base these on the constant arm a. Thus if K_M is the moment coefficient of the rotor about the C.G.—

$$K_M \rho \pi R^2 a V^2 = X(a \cos i - x \sin i) - Z(x \cos i + a \sin i)$$

$$K_M = K_X\left(\cos i - \frac{x}{a} \sin i\right) - K_Z\left(\frac{x}{a} \cos i + \sin i\right). \quad (6)$$

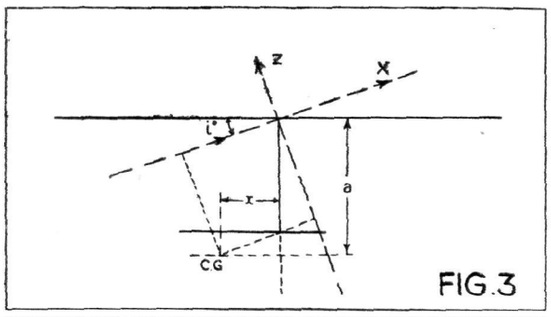


FIG. 3

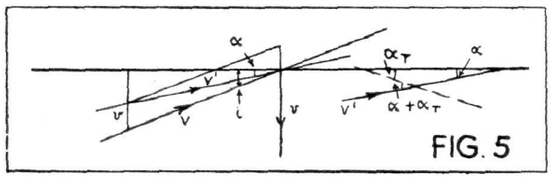


FIG. 5

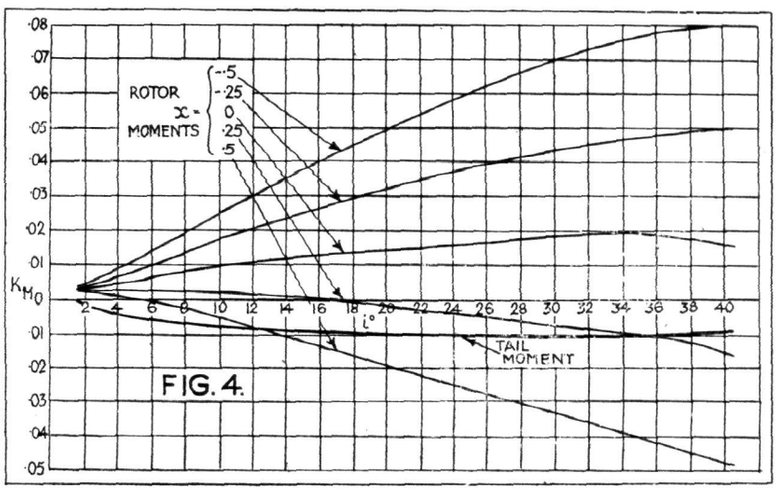


FIG. 4.

K_M has been worked out for the five different C.G. positions over the whole range of incidence; these are shown in Fig. 4. A body moment has been included, but this is not important. The body is assumed to have a constant centre of pressure forward of the C.G. and below it (as the C.G. of an Autogiro is always high in the fuselage). The moment will then be of the form

$$B_M = K_1 \sin (i - K_2)V^2 \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (7)$$

K_1 and K_2 have been given values by assuming that the moment is zero at 10 deg. incidence, and also that the arm of the drag force is 6 in. at low incidence. K_M will be taken to include the coefficient due to equation (7).

Before we can estimate the lift due to the tail we must have the velocity over the tail and the angle of attack. Referring to Fig. 5, the axial induced velocity of an Autogiro is given by equation (11) of R. & M. 1111—

$$v = \frac{T}{2\pi R^2 \rho V^1} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (8)$$

where T is the thrust (equal to the weight) and V^1 is the resultant of V and v. It is assumed that v has a constant value over the disc, so that the downwash velocity over the tail is also v. V^1 is given by—

$$V'^2 = (V \sin i - v)^2 + V^2 \cos^2 i \quad . \quad . \quad . \quad . \quad . \quad . \quad (9)$$

If α is the incidence of V^1 to the normal to the shaft, then

$$\text{Tan } \alpha = \left(\frac{V \sin i - v}{V \cos i} \right) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (10)$$

Hence, if α_T is the tail setting to the normal to the shaft, the true incidence at the tailplane is $(\alpha + \alpha_T)$ and the velocity over the tailplane V^1. In order to find v and V^1 we must proceed by approximations. Since $v = \frac{K}{V^1}$ by putting $V^1 = V$, we obtain a value for v, and inserting in equation (9) obtain V^1 and then re-insert this in the equation for v and so on.

As regards tail characteristics, we have put the slope of lift coefficient against incidence equal to 0.02, so that

$$K_L = 0{\cdot}02\ (\alpha + \alpha_T) \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (11)$$

and tail lift = $TL = K_L \rho S_T V'^2 = 0{\cdot}02\ (\alpha + \alpha_T) \rho S_T V'^2$. (12)

If the arm of the tailplane is measured normal to the shaft, then the tail lift moment is

$$(TL)_M = -\ 0{\cdot}02\ (\alpha + \alpha_T)\ \rho S_T V'^2\, l \cos i \quad . \quad . \quad . \quad . \quad (13)$$

or expressed as a coefficient to be added to K_M

$$K'_M = -\ 0{\cdot}02\ (\alpha + \alpha_T) \frac{S_T}{\pi R^2} \left(\frac{V^1}{V} \right)^2 \frac{l}{a} \cos i \quad . \quad . \quad . \quad (14)$$

For the purpose of showing static stability it is, of course, immaterial what value we take for α_T, so this has been put equal to zero. The tail-moment coefficients are shown for $x = 0.5$ on the same curve as the rotor moments, Fig. 4; owing to their close coincidence only one curve is given.

The sums of these moments $(K_M + K'_M)$ which we shall call $\overline{K}_M$, are shown plotted in Fig. 6. A negative slope for these curves indicated static stability. It will be seen, therefore, that the aircraft is stable with the C.G. in front of the shaft and unstable with the C.G. aft. With the C.G. directly under the shaft the moment curve shows slight instability. The stability, however, is best shown by means of tail-setting curves by assuming the aircraft to be in equilibrium. In addition, we shall see from these curves the amount of control required for any speed, and hence by assuming a certain amount of control to be available, shall be able to arrive at the possible gliding angles for different C.G. positions. Accordingly we put

$$K_M \rho \pi R^2 V^2 a = 0{\cdot}02\ (\alpha + \alpha_T)\ \rho S_T V'^2 l \cos i$$

$$\text{or } \alpha_T = \frac{K_M \pi R^2 V^2 a}{0{\cdot}02\ S_T V'^2 l \cos i} - \alpha \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (15)$$

where α is found by means of equation (10). These values for α_T assume, of course, that the elevator is held in line with the tailplane. They can be interpreted in terms of elevator setting by putting

$$\alpha_T = \alpha'_T + \frac{b}{a} \eta \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad (16)$$

where α'_T is the setting of the tailplane and η that of the elevator. $\frac{b}{a}$ is plotted in R & M. 1095. It will be sufficient for our purpose, however, to use values of α_T. These values are plotted against V for the five different C.G. positions by means of equation (15) and are shown in Fig. 7. A negative slope indicates instability the same as for the $\overline{K}_M$ curves. It will be apparent how very unstable the machine becomes with the C.G. either under or aft of the vertical shaft at low speeds.

As regards control, we have assumed for the purpose of obtaining definite figures a maximum control angle on the tailplane of ± 20 deg. This is taken to be the value of α_T from equation (16) when α'_T and η have their respective maximum values. The positive limit does not really interest us since the aircraft would not fly at such low speeds without the C.G. being in front of the shaft, but it has been included in Table I for the purpose of showing how the maximum available control limits the gliding angle. Table I shows the maximum possible gliding angle and the components of velocity for different C.G. positions. The $x = 0$ point has had

to be extrapolated somewhat, and it is doubtful if this is justified, since the minimum velocity possible for the Autogiro might well be above 32 ft. per sec.

Taking the two possible C.G. positions, $x = 0.5$ and $x = 0.25$, it will be seen that a great deal is to be gained by having the C.G. at 0.25 in preference to 0.5. The gliding angle is increased from 20.8 deg. to 34 deg. with only an increase of about 7 ft. per sec. in the vertical speed. The vertical component at $x = 0.25$ should still be low enough to be dealt with by the undercarriage, and the horizontal component is only 20 m.p.h.

TABLE 1

$\alpha_T = \pm 20°$

C.G. x	V F.P.S.	Horizontal Comp. of V F.P.S.	Vertical Comp. of V F.P.S.	Gliding Angle
0·5	47	44	16·3	20·8°
0·25	35·5	29·4	23·5	34°
0	32	21·8	23	47°
−0·25	42·5	38·6	17·2	24·5°
−0·5	54·5	52·0	16·1	17·2°

If the tailplane had an available range of 90 deg. it would make but little difference to the possible gliding angles, since the maximum-lift coefficient of the tailplane would be reached at a speed very little less than the speed corresponding to 20 deg. setting, and the aircraft can then no longer be in equilibrium.

An aircraft rarely lands in absolutely still air; this, no doubt, accounts for the steep angles at which an Autogiro descends, and is in fact the only way in which to account for vertical descent. The horizontal speed of the Autogiro is $\sqrt{V^2 - V_v^2}$. If V_w is the wind velocity the speed relative to the ground is then $\sqrt{V^2 - V_v^2} - V_w$. Hence, if ϕ_w is the gliding angle relative to the ground with wind velocity V_w, then

$$\text{Tan } \phi_W = \frac{V_v}{\sqrt{V^2 - V_v^2} - V_W} \quad . \quad . \quad . \quad . \quad (17)$$

Values are given in Table 2 of wind speed necessary to convert ϕ into different values of ϕ_w. Considering the case of the C.G. at $x = 0.25$, the possible gliding angle in still air is 34 deg. and a wind speed of 29 ft. per sec., or 20 miles per hr., is necesary to change this to a gliding angle of 90 deg., or, if we take 70 deg. as constituting an apparent vertical descent, the wind speed necessary is only 23 ft. per sec., or 16 miles per hr. The horizontal landing speed under these conditions is only 6 miles per hr., which means practically zero landing run.

TABLE 2

$\phi°$	Wind Speed (F.P.S.) necessary to alter ϕ to				
	50°	60°	70°	80°	90°
20	31	35	39	42	45
25	23	28	32	34	37
30	17	22	26	30	33
35	12	17	22	25	29
40	8	12	18	22	26

It is quite likely that the figures given above might be considerably improved upon in the latest Autogiros, more particularly in the C.30, in which control is obtained by tilting the rotor backwards. This has the effect of putting the C.G. further aft at the higher incidences, and so securing a steeper gliding angle. Then again the characteristics of the latest Autogiros may somewhat modify the calculations.

Cierva records in the Journal of the Royal Aeronautical Society that an Autogiro has for a short time reached an incidence of 87 deg. This is no doubt possible at the instant of landing provided the pitching moment of inertia is sufficiently great to balance the forces out of equilibrium. This incidence could, of course, be reached by means of gust velocities.

It has been assumed in the above calculations that the incidence of maximum K_L is about 40 deg. This again may be increased in the C.30, thus resulting in the considerable advantage of slow vertical speed at high angles of incidence. There is, of course, no reason why an Autogiro should not fly well beyond the maximum-lift coefficient, since the danger of a sudden stall due to loss of control is entirely absent with the Autogiro. Provided there is the control available, there is no reason why any incidence should not be reached, and once this incidence is attained, although control falls off, the aircraft will just sink down slightly more rapidly, since it must be laterally stable at all angles of incidence.

It is this fact, that the incidence of maximum K_L can safely be passed, that gives the Autogiro such an advantage over the aeroplane, for, after all, safety must be the first criterion of any aircraft. There is little doubt that the Autogiro will play a big part in the future of air transport.

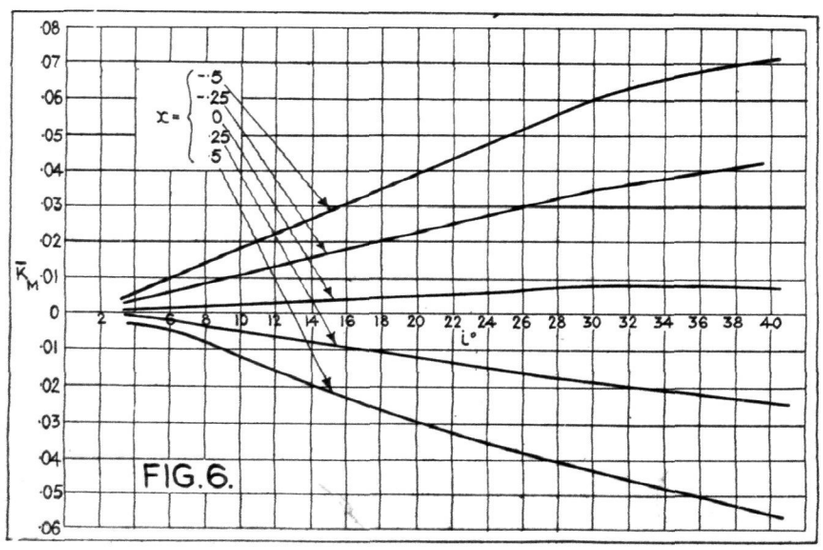


FIG. 6.

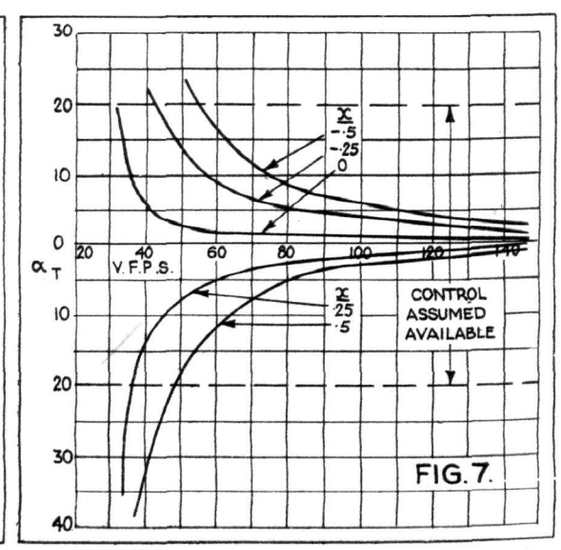


FIG. 7.

TECHNICAL LITERATURE

SUMMARIES OF AERONAUTICAL RESEARCH COMMITTEE REPORTS

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OIL COOLING FOR AIRCRAFT. By B. C. Carter, F.R.Ae.S., M.I.Mech.E. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1486. (58 pages and 36 diagrams.) September, 1931. Price 3s. 6d. net.

This report has been prepared as a review of means of oil cooling for aircraft and as an analysis of the problem of oil cooling. It is comprehensive in its survey and deals with all the main problems on this subject as affecting present day engines. For convenience the subject has been grouped into three sections.

In Section 1, the chief basic quantities involved are reviewed and some values for cooling coefficients, etc., are given for reference purposes.

In Section 2, a quantitative analysis is made of the rate of transference of heat from oil to metal and from metal to air. This analysis is based on simple theory, using the results of certain tests. A form of graph has been devised for depicting the characteristics of oil coolers as regards heat transference. Some estimates are made of thickness of virtual laminar layers of oil, in contact with the metal surfaces of coolers, through which the heat passes by conduction only. This matter is considered in fuller detail in Appendix I, and the transference of heat from a fluid in laminar motion is examined in Appendix II.

In Section 3, types of oil coolers in use, under trial, or proposed, are described. Some information is given concerning the performance of these coolers, and in certain cases the results of tests are analysed.

In Appendix III, the use of an intermediate fluid in the cooling of oil is considered and some test results are given.

Little difficulty presents itself in arranging to dissipate two or three horse-power from the oil, but for higher rates of dissipation, particularly in a warm climate, an oil cooler tends to become bulky and heavy, and possibly to have excessive drag.

The importance of drag depends upon the speed of the machine, as well as upon the design of the cooler, because the power absorbed in drag increases almost as the cube of the airspeed, whereas the heat dissipation increases at a lower rate than the first power of the airspeed. Put otherwise, the ratio of the power absorbed in drag to that represented by the rate of heat dissipation, increases practically as the square of the speed. At low aircraft speeds, this ratio is so small that the power lost in drag is negligible, but, at higher speeds, the drag horse-power may be very important if the cooling surface is not part of the aircraft surface.

For racing aircraft, it is essential to employ part of the aircraft surface for oil cooling, and for high speed non-racing aircraft it is desirable to do the same.

To get the best results involves making arrangements for oil cooling at an early stage of the machine design, with sufficient information available to enable the cooler performance to be predicted. At present there are important gaps in our knowledge of the subject, and a corresponding element of doubt concerning the provision that needs to be made for oil cooling.

The amount of horse-power that will require to be dissipated from the oil to prevent excessive feed temperatures is largely a matter of surmise because it depends upon the degree of cooling of the engine as installed. A considerable amount of cooling is often effected in the oil tank and pipes. Thus, when oil temperature measurements are made, the location of the thermometers has an important bearing on the interpretation of the results. Even if the horse-power to be dissipated is known, the size of cooler required cannot be estimated within very close limits, except from previous practice, because the metal-air and oil-metal heat transfer coefficients depend upon many factors.

From the values of these coefficients given in this report, it should be possible to make some progress towards superseding trial and error methods and towards the adoption of oil coolers which do not involve added drag.

Where oil is sprayed on a surface above the oil level in the tank and drains away from the surface, the cooling element cannot become filled with congealed oil. Thus the danger is eliminated of the cooler ceasing to control the feed oil temperature under all flight conditions. The method has a further advantage which concerns vulnerability. In the event of the cooling element being punctured, the rate of oil leakage is small in relation to the rate at which the total oil content of the system is circulated.

When the sprayed surface is below the oil level in the service tank, no air vent is provided and the cooler acts as an air vessel under the small pressure needed to force the cooled oil through a pipe discharging above the oil in the tank.

Spraying introduces its own difficulties and these should be mentioned. To get the best results from spraying involves using a pressure of 30 to 50 lb. per sq. in., and where scavenge pumps have not been developed to operate against a back pressure of this magnitude, troubles have arisen in isolated instances with frothing, cavitation at the scavenge pump inlet and pressure fluctuation. These have been due to the presence of air and are peculiar to the engines concerned. Many other tests have been made without such troubles occurring. They should not arise if a separate pump, running full, were fitted for circulating the oil through the spray cooler (and cleaner where incorporated in the cooler) and back to the engine sump. With this arrangement a high rate of circulation may be adopted to obtain vigorous spraying when the rate of heat dissipation necessitates spraying a large area.

If an oil cooler under trial is found not to give the amount of cooling required it is desirable to determine the coefficients of heat transference from oil to metal and from metal to air. The latter coefficient may be found in wind tunnel tests by circulating water vigorously instead of oil, and such tests incidentally give the upper limit to the possible performance with oil. The oil-metal coefficient for each wind tunnel test made with oil may then be deduced. An analysis made in this way should indicate any changes that would give improved performance for the conditions under which the cooler is to be used.

It is for consideration whether further wind tunnel tests be made on the more important types of cooler that project into the relative wind, in order to determine the drag, and the coefficients of heat transference under different conditions as regards wind speed, temperatures and rates of oil circulation. The oil-metal coefficient for various oil and metal temperatures needs to be correlated more closely with the Reynolds number and other non-dimensional quantities for specific types of oil coolers, and further experiments might be made with this objective. These would not involve the use of a wind tunnel.

In preparing this report, the author has drawn freely upon the results o tests made by his colleagues at the Royal Aircraft Establishment in the Departments concerned.

EXPERIMENTS ON SWEPT-BACK AND SWEPT-FORWARD AEROFOILS. By D. H. Williams, B.Sc., and A. S. Halliday, B.Sc., Ph.D., D.I.C. With an Appendix by H. B. Irving, B.Sc. R. & M. No. 1491. (22 pages and 21 diagrams.) October, 1930. Price 1s. 3d. net.

In the Appendix to this report, H. B. Irving has given some results deduced from pressure plotting data on the effects of sweep-back and sweep-forward on the aerodynamic characteristics of an aerofoil, showing that a swept-forward wing might possess marked advantages over a straight wing or one with sweep-back. A delayed stall and an increase in lift at high angles of incidence due to sweep-forward were indicated and also an increase in the rolling moment due to sideslip above the stall. The experiments described below were carried out to test the conclusions by determining the rolling moments due to sideslip and roll on an aerofoil with various angles of sweep-back and sweep-forward.

The wings tested were rectangular, aspect ratio 6, with square wing tips. They were mounted in two parts on a metal plate in such a way that each half could be rotated independently about an axis normal to the aerofoil in the centre section up to 30° each way. In this way, wings with any angle of sweep-back or sweep-forward could be constructed, but each wing tip section was at right angles to the centre line of the corresponding half of the wing; the wing tip section was, therefore, not along the wind direction at 0° yaw, except for the straight wing.

The general conclusions deduced from the experiments may be summarised as follows:—

(1) Sweep-back and sweep-forward decrease the lift below the stall and the maximum lift coefficient, but they increase the lift above the stall.

(2) 10° sweep-back halves the value of l_v above the stall but has little effect below the stall. 10° sweep-forward increases l_v above the stall and reduces it below the stall.

(3) Moderate sweep-back tends towards instability in roll, while sweep-forward postpones the change from stability to instability.

A STUDY OF AIRCRAFT TURNING PERFORMANCE. PART I. By S. B. Gates, M.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1502. (8 pages and 11 diagrams.) August 10, 1932. Price 6d. net.

A method of calculation is proposed by means of which the steady spiral motion of an aircraft at small angles to the horizon can be simply deduced from knowledge of its angles of climb and glide in rectilinear flight. Curves are shown illustrating (*a*) true banked turns at various rates of descent, and (*b*) level turns with various degrees of sideslip. A rough estimate is made of the effect of wing-tip slots. Equilibrium of forces only is considered, and the limitations introduced by available control will be studied in a later report.

PERFORMANCE TESTS OF CERTAIN EXPERIMENTAL DESIGNS OF DIFFUSER AND IMPELLER IN A CENTRIFUGAL SUPERCHARGER, WITH PARTICULAR REFERENCE TO THEIR INFLUENCE UPON SURGING, INCLUDING THE EFFECT OF AN IMPRESSED PERIODICITY OF FLOW. By G. V. Brooke, B.Sc.Tech. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1503. (43 pages and 28 diagrams.) December, 1932. Price 2s. 6d. net.

The majority of centrifugal superchargers constructed for aero-engine service have utilised diffusers containing either a comparatively large number of short, straight vanes or a smaller number of curved vanes of greater length. In bench calibration tests of such superchargers at constant rotational speed of the impeller, in which the mass flow of air is progressively reduced by restricting the outlet from the supercharger, it is found that the pressure of the air at delivery increases as the mass flow diminishes until a point is reached at which the discharge pressure decreases abruptly. This sudden breakdown in the character of the relation between delivery pressure and mass flow is generally termed the "surge point." As a rule it is accompanied by an audible air vibration, the severity of which is greatly influenced by the volume of air enclosed in the pipe system between the supercharger and the valve used for throttling the air flow.

Tests were undertaken to determine the comparative performance of a supercharger and the relative proximity of the air flows corresponding respectively to maximum performance and to the inception of surging when several experimental types of diffuser and impeller were incorporated. The components tested included both shrouded and unshrouded impellers having either curved or straight radial blades, and diffusers (1) of simple vaneless type; (2) containing straight vanes set at various angles; and (3) constructed in the form of two equiangular spiral volutes.

The simple vaneless diffuser was beneficial in regard to the postponement of surging, but produced very low values of adiabatic efficiency and pressure ratio of compression. A diffuser of this type is unsuitable for use in a high-speed compressor of small overall diameter, as the length of diffuser passage available is insufficient for reduction of the final air velocity to the required value. The performance of the supercharger was influenced to a considerable extent by change of the diffuser vane angle.

Improvements in compression ratio and efficiency were obtained from the shrouded impellers. In particular, the design incorporating curved blades afforded a very high compression ratio, but its maximum value at each impeller speed was reached at an air flow in close proximity to that at which surging commenced.

Comparing the performances of the supercharger on the basis of the useful power which it enables a hypothetical engine to develop, and excluding the cases of the plain vaneless diffuser and the less favourable vane angles, no

very pronounced superiority was exhibited by any of the combinations of experimental components tested, although the spiral volute diffuser possessed certain characteristics rendering it particularly suitable for application to aircraft engine superchargers.

A STATISTICAL METHOD OF INVESTIGATING THE RELATIONS BETWEEN THE ELASTIC STIFFNESSES OF AEROPLANE WINGS AND WING-AILERON FLUTTER. By H. Roxbee Cox, Ph.D., D.I.C., B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1505. (30 pages and 9 diagrams.) October 17, 1932. Price 1s. 6d.

With the object of preventing in actual wing-aileron systems the occurrence of flutter or divergence, Frazer and Duncan have made certain recommendations in their papers*† on the theory of wing-flutter regarding the design of such systems.

Several of these recommendations are in the form of precise statements needing little amplification, but others are of a qualitative nature and need further definition before they can be applied in design. Of the latter kind, the most important is the recommendation which reads: "All elastic stiffnesses as large as possible," and the present paper describes first steps towards the enunciation of a quantitative substitute, suitable for use in design.

Even if the other recommended measures for the prevention of flutter and divergence had been completely ignored by a designer, it would be theoretically possible by sufficiently increasing the elastic stiffnesses of the wing-aileron system, to preclude the occurrence in flight of the instabilities in question. This, even if practicable, would clearly be an extremely wasteful method of achieving immunity from flutter and divergence, and it is more to the point to attempt to discover the minimum degree of elastic stiffness which is necessary to prevent instability when as many as possible of the other preventive measures have been effected. It is emphasised that the quantitative conclusions of this report should be regarded as stepping stones towards this end, and that high stiffness should not be considered as a flutter prevention measure alternative to a proved preventive measure such as aileron mass-balance.

Criteria based on stiffness are developed, by means of which the relative liabilities to wing-aileron flutter of the wings of different aircraft may be compared. Providing the requisite data are obtained for a sufficiently large number of aircraft of various types, these criteria can be used to deduce approximate minimum safe stiffnesses both for aircraft with no specific anti-flutter design features, and for aircraft embodying such features. The procedure for using them to this end is illustrated in the report by diagrams in which the criteria for a number of aircraft are plotted against wing density, a parameter which is shown to have an important influence upon critical flutter speed.

While the report is intended primarily to describe the development of a method, the diagrams represent some advance towards the specification of minimum safe stiffnesses for monoplanes with and without aileron mass-balance, and for biplanes with and without half of their aileron area inboard of their outer interplane struts.

* R. & M. 1155. "The Flutter of Aeroplane Wings. Frazer and Duncan.
† R. & M. 1255. "The Flutter of Monoplanes, Biplanes and Tail Units." R. A. Frazer and W. J. Duncan.

THEORY OF LOSS OF LATERAL CONTROL DUE TO WING TWISTING. By H. Roxbee Cox, Ph.D., D.I.C., B.Sc., and A. G. Pugsley, M.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1506. (11 pages and 6 diagrams.) October 14, 1932. Price 9d. net.

In a preliminary report* the present writers put forward a simple theory of loss of lateral control due to wing twisting which was intended to provide a basis for the estimation of the critical reversal speed for a given wing. Subsequent contributions to the subject now make it possible and desirable to set out the original theory in a more general form.

A general expression for the effective rolling moment produced by a small aileron displacement is developed for a semi-rigid wing and the critical reversal speed at which this moment becomes zero deduced. The application of the theory for the prediction of critical reversal speeds for actual wings is then considered and illustrated by reference to certain wings for which the critical speed is known.

The theory appears to be satisfactory for the practical prediction of critical reversal speeds for wings of normal aerodynamic and elastic characteristics.

* Loss of Lateral Control in Aeroplanes due to Elastic Deformation of the Wings.—H. Roxbee Cox, Ph.D., and A. G. Pugsley, M.Sc. (R.A.E. Report A.D. 1603/D, Strut, 58, 1931. Unpublished.)

DISTORTIONS OF STRIPPED AEROPLANE WINGS UNDER TORSIONAL LOADING. By D. Williams, B.Sc., A.M.I.Mech.E. With an Appendix on "The Application of the Method described in the Report to the Problem of the Continuous Beam under Lateral and End Loads," by H. Roxbee Cox, Ph.D., D.I.C., B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1507. (23 pages and 12 diagrams.) August 11, 1932. Price 1s. 3d. net.

The investigation of the characteristics of an aeroplane wing in relation to flutter,* and more especially in relation to loss of lateral control,† necessitates among other things a knowledge of the torsional stiffness of the wing. The problem treated in this report is that of finding the torsional stiffness of an aeroplane wing that consists of two spars connected together by stiff ribs at frequent intervals along the span. In a recent paper‡ Roxbee Cox deals with the special case in which the spar sections and the distance between the spars are constant. When these quantities vary along the span in some arbitrary fashion, an analytical solution becomes impracticable and as, in actual spars, this is the type of variation to be expected, it becomes necessary to find some other method of solution. The method here used is that of graphical successive approximations and is analogous to the analytical method of Picard. The manner of its application to various cases is described in the following pages. One example is worked out in detail in order to illustrate the procedure adopted.

* "A statistical method of investigating the relations between the elastic stiffnesses of aeroplane wings and wing aileron flutter."—H. Roxbee Cox, Ph.D. (Unpublished.)
† "Theory of loss of lateral control due to wing twisting."—H. Roxbee Cox, Ph.D., and A. G. Pugsley, M.Sc. (R. & M. 1506.)
‡ "Torsional loading on stripped aeroplane wings."—H. Roxbee Cox, Ph.D., D.I.C., B.Sc. (R. & M. 1436.)

THE CALCULATION BY SUCCESSIVE APPROXIMATION OF THE CRITICAL REVERSAL SPEED FOR AN ELASTIC WING. By A. G. Pugsley, M.Sc., and G. R. Brooke, Nat. Dipl. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1508. (10 pages and 10 diagrams.) October 14, 1932. Price 9d. net.

The critical reversal speed for a semi-rigid wing may be expressed directly in terms of certain readily determinable characteristics of the wing and aileron.* For an elastic wing, it appears at present that the most convenient method of accurately calculating the critical reversal speed is by a process of successive approximation. In the present report, this method is described in detail and illustrated by its application to a particular elastic wing.

The author concludes that, provided the wing aerofoil and aileron aerodynamic characteristics are known, the method appears capable of giving accurate results without excessive labour.

* "Theory of Loss of Lateral Control due to Wing Twisting."—H. Roxbee Cox, Ph.D., and A. G. Pugsley, M.Sc. (R. & M. 1506, 1932.)

THE STABILITY OF THE STATIC EQUILIBRIUM OF THE ELASTIC AND AERODYNAMIC ACTIONS ON A WING. By H. Roxbee Cox, Ph.D., D.I.C., B.Sc., and A. G. Pugsley, M.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1509. (20 pages and 2 diagrams.) October 3, 1932. Price 1s. net.

The aerodynamic loading on the wings of an aeroplane in flight depends upon the equilibrium conditions for the aeroplane as a whole, and, owing to wing elasticity, upon the conditions governing the equilibrium of the wings themselves. The former conditions vary with the flight case under consideration, but in all cases the latter conditions are similar in that the aerodynamic and elastic actions on a wing are interdependent.

This report discusses this fundamental inter-dependence for the case of a wing held at its root in a steady air stream, a problem in which conditions governing the equilibrium of the wing as a whole do not obtrude. For this case the necessary mathematical theory is developed and the analytical results given are suitable for application to actual aeroplane problems such as those concerning wing strength for various conditions of flight or those concerning aeroplane stability.

THE TURBULENCE IN THE WAKE OF A BODY. By A. Fage, A.R.C.Sc. R. & M. No. 1510. (7 pages and 8 diagrams.) September 7, 1932. Price 6d. net.

When a very long cylindrical body is immersed in a steady fluid stream of infinite extent, vortices are shed alternately from the sides of the body and a vortex street is formed behind the body, if the Reynolds number is sufficiently high. At some distance downstream the vortex street breaks up and the vorticity created by the body becomes diffused across the wake. Although the flow is then unsteady, the distribution of mean velocity across the wake tends to be two-dimensional in planes at right angles to the length of the body.

The conditions of flow behind an infinitely long body immersed in an infinite stream cannot be realised in practice. A close approach to this ideal two-dimensional mean flow can, however, be obtained behind the central part of a body whose length is great compared with its breadth, if the stream is initially steady, and if the wake is bounded on its two sides by steady streams of appreciable breadth.

At a sufficiently high Reynolds number the wake behind a long bluff cylindrical body settles down to a permanent régime in which the velocity disturbances are three-dimensional. The maximum values of the three components of the velocity disturbances were found to be about the same. A special type of flow, in which the disturbances became two-dimensional as the plane of symmetry was approached, was revealed at a low Reynolds number.

The conclusion is drawn that the velocity disturbances in the eddying wake behind any long cylindrical body, bluff or streamline, will be three-dimensional if the Reynolds number is sufficiently great, even although the mean flow in planes at right angles to the length tends to be two-dimensional.

THE EFFECT OF TURBULENCE ON THE DRAG OF AIRSHIP MODELS. By Hilda M. Lyon, M.A., A.F.R.Ae.S. R. & M. No. 1511. (28 pages and 27 diagrams.) August 9, 1932. Price 1s. 9d.

The degree of initial turbulence in the air stream of a wind tunnel has an important effect on the results obtained from measurements of the resistance of airship models. This effect was clearly demonstrated by the international tests on two N.P.L. models, which showed a wide range of values for the resistance of the same model when tested in different tunnels at the same Reynolds number. A summary of the results of the tests in the American tunnels covers the whole range.* The highest values for the resistance coefficient, obtained in the tunnels with the most turbulent flow, were found to be approximately double the lowest values obtained in the tunnels with a relatively smooth or non-turbulent flow for a Reynolds number of $10-46 \times 10^6$. In some later experiments at the Bureau of Standards it was proved conclusively that such discrepancies were due to varying degrees of initial turbulence.† Experiments at the National Physical Laboratory have also shown that the same effect could be produced by placing a wire mesh screen inside the tunnel at various distances from the model.‡

The object of the present experiments was to examine the effect of varying degrees of initial turbulence in the wind tunnel on the relative values of the drag coefficients of two airship models having the same fineness ration (5 : 1) but different block coefficient (0·58 and 0·7).

Measurements were made, over a range of Reynolds number of 500,000—1,600,000, of the drag of each model in the bare tunnel and also behind each of three screens placed at various distances from the model. The intensity of turbulence was roughly calibrated by means of resistance measurements on a sphere. Measurements were also made of the normal pressure at various positions along the surface of each model without a screen in the tunnel and for one position of the intermediate screen.

In the bare tunnel the drag coefficient of the model with the higher block coefficient was found to be about 50 per cent. higher than that of the other model at a Reynolds number of 1,600,000. With increasing turbulence the drag coefficients for the two models increased and approached one another until they finally became equal for the highest degrees of turbulence obtained. The difference between the drag coefficients without the screen appears to be due to an earlier transition from laminar to turbulent flow in the boundary layer of the model with the bluffer nose, which is consistent with the distribution of normal pressure over the surface. This difference is eliminated by the introduction of artificial turbulence in the wind tunnel stream, which causes the transition point to move forward on both models. It is concluded that, for the full scale airship, where the boundary layer of either shape is probably almost wholly turbulent, there is nothing to choose between the two shapes from the consideration of resistance alone.

* N.A.C.A. Technical Note 264. Figs. 3, 4 and 5.
† Dryden and Keuthe. N.A.C.A. Reports 342, 392.
‡ R. & M. 597. "The effect of up-wind disturbances in the air current of the channel upon the forces on models with special reference to the effect on the drag of an airship model." Relf and Lavenden.

THE EFFECT OF A TRACTOR AIRSCREW ON BODY-WING INTERFERENCE. By E. Ower, B.Sc., A.C.G.I., R. Warden, Ph.D., M.Eng., and L. J. Jones. R. & M. No. 1512. (35 pages and 13 diagrams.) November 25, 1932. Price 1s. 9d. net.

Researches carried out at various Institutions during the last few years have yielded much information on the mutual interference between the fuselage and the wings of aircraft when not affected by the airscrew slipstream. On analysis, this information has indicated certain general features upon which the interference seems mainly to depend, and has consequently enabled recommendations to be drawn up for the avoidance of the construction of body-wing combinations having high interference drag. A full account of them and of the evidence upon which they rest will be found in the recently published report R. & M. 1480.* It is, however, of importance to know how, if at all, these recommendations need modification when the slipstream from the airscrew plays upon the junctions of wings and body where the major part of the interference has its origin. This is considered in the present report.

Measurements of lift and drag have been made on a streamline body with a tractor airscrew at the nose, and with wing roots of R.A.F. 31 section attached to it in various positions above and below its horizontal median plane, and at a constant axial distance from the nose. The body used was a smaller scale model of that used for the similar work done without airscrew and described in R. & M. 1480, and the general proportions of the body-wing combinations were approximately the same as in the earlier work. The airscrew used was a four-blader of P/D ratio 0·7 and diameter 19·25 in. Measurements were made of net thrust, net torque, and lift of the various combinations for values of V/nD ranging from 0 to 1. In addition, measurements of lift and drag were made with the airscrew removed.

Although the relative merits of different combinations may be somewhat altered quantitatively by the slipstream, qualitatively no important modification was observed. The low tangential wing position on the body of circular cross section was still very distinctly the worst of those tested, while the best was that with the wing chord slightly above the centre line of the body. The slipstream effects a relative improvement of the bad wing positions (but without rendering them actually superior to the good positions) and there is also evidence that it spoils positions in which the wings are high on the body. In general, the wings reduce the rotation in the slipstream by an amount which is greater the better the wing position as judged on the basis of its interfernece drag. In bad positions the wings may sometimes introduce additional rotation into the slipstream.

In an Appendix the results are analysed by an application of the theory of airscrew-body interference developed by Lock and Bateman, and it is shown that a simplified form may be used to predict the net thrust with fair accuracy.

* "Some aspects of the mutual interference between parts of aircraft." —Ower.

THE HEATS OF FORMATION OF NITROUS OXIDE AND CARBON DIOXIDE. PART I. By J. H. Awbery, B.A., D.Sc., and Ezer Griffiths, D.Sc., F.R.S. PART II. By R. W. Fenning, M.B.E., B.Sc., D.I.C., and F. T. Cotton, B.Sc. Work done for the Department of Scientific and Industrial Research. R. & M. No. 1513. (42 pages and 13 diagrams.) February, 1933. Price 2s. 6d. net.

An investigation on the properties of fuels that is proceeding at the N.P.L. called for an accurate knowledge of the heat of formation of nitrous oxide. Since the published values of this constant differed widely, a redetermination of its value was undertaken with a view to obtaining as high an experimental accuracy as possible.

The heat of formation of nitrous oxide has been determined by a continuous flame method at constant pressure (described in Part I) and by an explosion method at constant volume (described in Part II). Incidentally, values have also been obtained of the heat of formation of carbon dioxide from carbon monoxide and oxygen.

In the constant pressure experiments, an adiabatic calorimeter was used to measure the heats of reaction, its extent of the reaction being determined by collecting and weighing the carbon dioxide produced. The results were converted into absolute values by calibrating the apparatus electrically.

In the constant volume experiments, a number of mixtures were exploded in a specially-designed bomb calorimeter of the adiabatic type for the purpose of determining the reaction heats. The mass of oxygen or nitrous oxide taking part in the explosion was computed from pressure, temperature and volume measurements of the gas concerned, and its amount was adjusted so that the heat imparted to the calorimetric fluid was sensibly the same in all cases.

The following are the comparative results of the experiments with those of other workers :—

Author	Date	Heat of formation of N_2O in kg.-cal.$_{15°}$ per mol.
Berthelot	1880	20.6
Thomsen	1905	17.74
Carlton-Sutton	1932	20.5 ± 0·3 (at 20 deg. C.)
Awbery and Griffiths ..	1932	19.5 (at 20 deg. C.)
Fenning and Cotton	1932	19.74 ± 0.07 (at 20 deg. C.)

Author	Date	Heat of formation of CO_2 in kg.-cal.$_{15°}$ per mol.
Berthelot and Petit	1889	68.22
Thomsen	1905	67.96 (at 18 deg. C.)
Roth and Banse	1931	67.86 ± 0·1 (at 20 deg. C.)
Rossini	1931	67.623 ± 0·030 (at 25 deg. C.)
Awbery and Griffiths ..	1932	67.57 (at 20 deg. C.)
Fenning and Cotton	1932	67.655 ± 0·035 (at 20 deg. C.)

SOME FULL-SCALE EXPERIMENTS WITH SERVO RUDDERS. By J. E. Serby, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1514. (8 pages and 17 diagrams.) July 8, 1932. Price 9d. net.

Servo rudders have been fitted satisfactorily to many aircraft.* To provide data for the design of servo rudders for larger aircraft and to cover the "flap" type servo design, a programme of tests was drawn up following on a report on the general aerodynamics of servo rudders (R. & M. 1105).† Both types of servo were tested in the wind tunnel, the tests covering two different sizes of servo chord and various hinge positions (R. & M. 1186).‡ A report (R. & M. 1187)§ on the theory of "follow-up" in servo systems was next made.

It was then decided that flight tests on a flap-type servo rudder fitted to a large aeroplane were desirable in order to check the wind-tunnel tests, and these form the subject of the present report.

The cross-wind force coefficients and main rudder moments have been measured on an all-moving rudder fitted with hinged flap type servo, for a range of servo positions.

The maximum cross wind force coefficient (k_L) obtainable with the rudder which was used in these experiments, and of which the aspect ratio was 2·4 is approximately 0·24 at an incidence of 14°. Shielding of the rudder by the tail causes a loss of rudder efficiency of 40 per cent. on the calculated values. The centre of pressure movement is large enough to be very important in large rudders with hinge positions set well back. The servo moments were extremely small.

* R.A.E. Report B.A. 528.—"Full-scale tests of a servo rudder on a D.H. 10." (Unpublished.)
† R. & M. 1105.—"The aerodynamics of a simple servo rudder system." —H. M. Garner and Flt.-Lt. Lockyer.
‡ R. & M. 1186.—"Wind tunnel tests of various servo rudder systems." —K. V. Wright.
§ R. & M. 1187.—"On the use of follow-up mechanism in aerodynamic servo control systems."—H. M. Garner and K. V. Wright.

FURTHER EXPERIMENTS ON THE SPINNING OF A BRISTOL FIGHTER AEROPLANE. By A. V. Stephens, B.A. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1515. (22 pages and 18 diagrams.) July 26, 1932. Price 1s. 3d. net.

The development of a method of determining completely the spinning motion of an aeroplane was described in R. & M. 1261.* In the same report the quantities defining eleven spins of a Bristol Fighter are given, and it is pointed out that although the control settings and loading of the aeroplane were approximately the same in each case, the characteristics of the spins varied widely. It was subsequently discovered that consistent results could be obtained if the spins were entered in a standard way. Recent experiments with dynamical models in the vertical wind tunnel have shown that although the transition from one type of spin to another may occupy a large number of turns, the final state is a definite function of the control settings and loading of the model.

The spinning motions of the aeroplane were completely determined from measurements of the vertical velocity and the components of angular velocity and linear acceleration at the C.G.

A number of spins were analysed in which, (*a*) the aeroplane was normally loaded ; (*b*) the longitudinal axis was loaded to increase the relevant moments of inertia without changing the position of the C.G. ; (*c*) the lateral axis was loaded ; (*d*) the elevator angle was varied ; (*e*) the rudder angle was varied.

It appears that the Bristol Fighter eventually attains a definite spinning attitude whatever method of entry is employed. Loading the longitudinal axis of the aeroplane induces slower and steeper spins, whereas loading the wing tips has the opposite effect and the difficulty of recovery is much increased. The generality of these effects is uncertain. Reducing the rudder angle invariably decreases the incidence of the spin, but moving the elevators down increases the rate of spin and has little effect upon the incidence. The outstanding difficulty in explaining the equilibrium of the spins lies in the balance of rolling moments (chord axes) and further work on this point is required.

* "Experiments on the Spinning of a Bristol Fighter Aeroplane."—Wright.

SOME POSSIBLE ADVANTAGES OF A VARIABLE-PITCH AIRSCREW. By W. G. Jennings, B.Sc. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1516. (25 pages and 11 diagrams.) October 10, 1932. Price 1s. 3d. net.

The object of the present report was to investigate the improvement in aircraft performance, including take-off, range, etc., that might be expected

to result from the use of a variable-pitch airscrew in place of the normal fixed-pitch airscrew. Since the performance of an aircraft is dependent on aircraft, engine and airscrew characteristics, it is expected that all cases cannot be covered by a general solution and that any comparison will be affected by the particular combination under consideration. In order to simplify the application of the general principles to particular problems, an attempt has been made to separate the various characteristics and to express the performance of an aircraft in certain generalised terms. In the course of this simplification a number of assumptions have been made which may lead to a somewhat less accurate estimation of the performance than that given by a prediction *ab initio* for a particular aircraft. It is considered, however, that the comparative results of the variable-pitch and fixed-pitch airscrews will not be seriously affected.

The following conclusions were reached :—

(1) When used with a normal aircraft and a normally aspirated engine the variable-pitch airscrew does not improve the climb or speed appreciably. With a supercharged engine the variable-pitch airscrew will give a marked increase in rate of climb below the supercharge height. The advantage of a variable-pitch airscrew increases with increase of aircraft speed range and may be greater for an aircraft designed for a specific purpose than for general-purpose aircraft.

(2) A large increase in static thrust is possible with a variable-pitch airscrew in the case of geared engines where high-pitch airscrews are normally required. For an ungeared engine with a low-pitch airscrew there is no appreciable gain in static thrust.

(3) For normal airscrews the maximum range is not greatly improved by varying the pitch. For low-pitch airscrews the increase in range is more marked.

(4) The variable-pitch airscrew may be used as an effective "air brake" to increase the gliding angle when approaching the landing ground.

(5) The variable-pitch airscrew is superior to a fixed-pitch airscrew with a two-speed gear as regards static thrust. A rather greater increase of range can be obtained by gear variation, but it should be noted that the change of gear ratio to increase range is in the opposite sense to that which gives increased static thrust.

LUBRICATION IN OXIDISING CONDITIONS. By R. O. King and C. Jakeman. Communicated by the Director of Scientific Research, Air Ministry. R. & M. No. 1517. (14 pages and 12 diagrams.) January, 1933. Price 1s. net.

The object of the experimental work was to investigate the effect of oxidation on the lubricating properties of oils. The experiments were made with journal bearings, the lubricating oil being maintained in a state of oxidation activity. The lubricants were commercial varieties of mineral oils, commonly used for aero engine lubrication. The investigation was begun with a bronze bearing bush having a particular degree of surface finish, but as this was found to be one of the factors determining the apparent lubricating value, the work was extended to determine the effect of surface state on lubricating performance.

The experiments were made at constant speed and load. Friction in the circumstances, falls as the temperature is raised, and generally passes through a minimum value (μ min.) at a temperature somewhat less than that of seizure (S.T.); lubricating value or performance is represented by the observed values of μ min. and S.T., which for a typical blended mineral oil were 0·0010 and 158° C. respectively at the beginning of oxidation. Viscosity was observed to increase with oxidation, but the consequent increase of fluid friction was apparent at temperatures below 50° only, that is, when the fluid film was relatively thick. Friction at higher temperatures decreased with the progress of oxidation and S.T. rose. Thus, after about 60 hours of oxidation, μ min. diminished to 0·00045 and S.T. exceeded 300° C. The oil in a state of partial combustion remained an effective lubricant, μ being less than ever recorded for fluid friction, even with air as the lubricant. A safe region of high-temperature lubrication was attained and experiments with various oils show that the extent of this region and the life of the oil depend on oxidation characteristics ; friction is due neither to viscosity nor to the action of the absorbed layer. The author suggests that the active or polar molecules formed during the early stage of oxidation build up to an appreciable thickness on the absorbed layer, and the friction observed is that on the surface of the built-up layer. The surface diminishes in rigidity in the direction of motion as the thickness of the boundary layer increases and friction approaches zero as a surface of complete slip tends to be reached.

THE PRESENT POSITION OF THE INVESTIGATION OF AIRSCREW FLUTTER. By W. J. Duncan, D.Sc., A.M.I.Mech.E., and A. R. Collar, B.A., B.Sc. R. & M. No. 1518. (44 pages and 13 diagrams.) December 15, 1932. Price 2s. net.

The present report is divided into three parts. Part I aims at giving a general review of past work on airscrew flutter, together with a brief and non-mathematical account of the investigations described in Parts II and III. The nature of airscrew flutter is discussed, and the conclusion reached that the "flutters" actually encountered are of several distinct types. It appears probable that wooden blades exhibit true flutter, *i.e.*, unstable coupled flexural-torsional oscillations. On the other hand, the oscillations of metal blades are probably usually due to resonance.

Part II is devoted to a mathematical discussion of the stability of a solid cylindrical blade in an airstream, and it is shown that there is a great simplification of the theory for massive blades of large aspect ratio. In particular, the critical flutter speed is almost independent of the position of the flexural centre in the chord, and of the density of the blade. The factors which principally control the critical speed are the torsional stiffness of the blade, the position of the centroid in the chord, and the air density. Concentration of the mass towards the leading edge and increase of torsional stiffness, either by thickening or by use of an inherently stiffer material, raise the critical speed. It is concluded that the same measures will have a like effect on the critical speeds of rotating airscrew blades.

Part III gives an account of some experiments on model airscrews with very flexible blades, and a simple arrangement for the visual observation of the flutter of rotating blades is described. The experiments provide a clear demonstration of the occurrence of unstable coupled oscillations of propeller blades, and they show that the critical flutter speed rises greatly as the centre of gravity is moved towards the leading edge.

AIR TORQUE ON A CYLINDER ROTATING IN AN AIR STREAM. By A. Thom, D.Sc., Ph.D., Carnegie Teaching Fellow, University of Glasgow, and S. R. Sengupta, B.Sc. (D.S.I.R. Student).* Communicated by Professor J. D. Cormack. R. & M. No. 1520. (7 pages and 10 diagrams.) October 22, 1932. Price 6d. net.

The air torque on a rotating cylinder has been measured throughout as large a range of rotational speed and wind speed as could be obtained, and the results are expressed as non-dimensional coefficients. The conclusions arrived at are :—(1) That throughout the greater part of the range the torque is approximately proportional to the product of the wind speed and the rotational speed. (2) That the resultant air force on the cylinder remains at roughly the same distance from the cylinder axis throughout the greater part of the range, namely about 0·008 × diameter. (3) Sanding the surface of the cylinder increases the torque from two to three times and affects the eccentricity in a like manner.

* Grant from Department of Scientific and Industrial Research.

(ABSTRACT.)

INTERCRYSTALLINE CORROSION OF DURALUMIN. By A. J. Sidery, Assoc.Met.(Sheff.), K. G. Lewis, M.Sc., and H. Sutton, M.Sc. R. & M. No. 1523. (3 pages.) March, 1933. Price 3d. net.

The paper, of which this is an abstract, deals with two aspects of the corrosion of duralumin. Experiments were made to determine the effects of certain modifications of heat treatment on the mechanical properties and on the corrosion-resistance of duralumin. An investigation was made of the influence of strain in tension and in compression on the tendency of heat-treated duralumin to develop inter-crystalline corrosion and on the influence of quenching in boiling water as compared with cold water in final heat-treatment.

ABSTRACT.

THE OXIDATION OF FUEL VAPOURS IN AIR. By E. Mardles, D.Sc., F.I.C. R. & M. No. 1524. (2 pages.) March, 1933. Price 2d. net.

The paper, of which this is an abstract, deals with a comparative study of oxidation characteristics and has a special bearing on the subject of knocking in the internal-combustion engine and on the theory of combustion in general. Ethane and normal pentane are representative of the normal paraffin hydrocarbons C_nH_{2n+2}, which are of relatively low anti-knock value, whilst ethylene and the amylenes are members of the olefine or unsaturated series of hydrocarbons, C_nH_{2n}, which possess relatively high anti-knock properties.

ABSTRACT.

DETONATION, SPARK-PLUG POSITION AND ENGINE SPEED. By R. O. King, M.A.Sc., and H. Moss, D.Sc. R. & M. No. 1525. (2 pages.) March, 1933. Price 2d. net.

Abstract only of paper published in *Engineering*, 1931, Vol. CXXXII, pages 177–180.

ABSTRACT : ON THE CALCULATION OF STRESSES IN BRACED FRAMEWORKS. By R. V. Southwell, F.R.S. R. & M. No. 1526. (1 page.) April, 1933. Price 2d. net.

Abstract only of paper published in the Proceedings of the Royal Society, A, Vol. 139, 1933.

A THEORY OF BINARY SERVO RUDDER FLUTTER, WITH APPLICATIONS TO A PARTICULAR AIRCRAFT. By W. J. Duncan, D.Sc., A.M.I.Mech.E., and A. R. Collar, B.A., B.Sc. R. & M. No. 1527. (23 pages and 6 diagrams.) February 13, 1933. Price 1s. 3d. net.

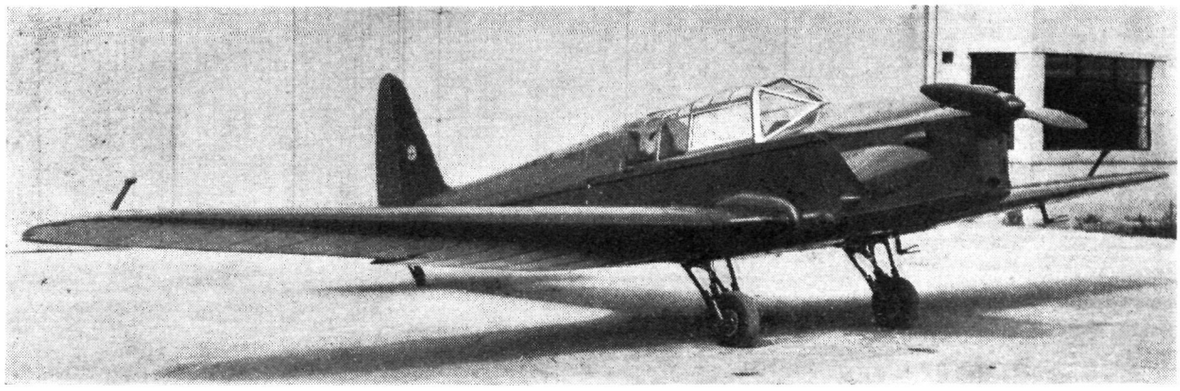
Several instances of flutter of servo-controlled rudders have arisen recently and an investigation has been authorised by the Aeronautical Research, Committee. The present report aims at giving a theory of servo-rudder flutter, together with a detailed application to the rudders of a certain aeroplane.*

The theory developed is based on the simplest possible assumptions. In particular, it is supposed that the motion impressed on the fuselage by the fluttering rudder can be neglected, so that the dyamical system becomes a binary one, the two degrees of freedom being the angular displacements of the main rudder and of the servo-flap. When the rudder bar in the cockpit is free, the motion is in many respects analogous to torsional-aileron wing motion, with the main rudder and servo-flap playing the parts of the wing and aileron, respectively. The analogy is, however, not complete, for the motion of the rudder is not subject to an elastic constraint such as is introduced by the torsional stiffness of the wing, and the aerodynamical stiffness of the rudder is positive (unless it is over-balanced), whereas the torsional aerodynamical stiffness of a wing for motion about the flexural axis is almost invariably negative. Nevertheless, it appears that the rudder flutter may be avoided by methods which are quite similar to those already devised for the prevention of torsional-aileron flutter. The really important preventive measure is mass balance of the servo-flap.

In the particular case investigated in detail calculation shows that a drastic over-mass-balancing of the servo-flap is unnecessary, and that ordinary mass-balance is actually sufficient. There do not appear to be adequate theoretical grounds for asserting that the ordinary degree of mass-balance will necessarily be sufficient in all cases, but it does appear highly probable that it will never be necessary to employ the drastic degree of over-balance which corresponds to elimination of the modified product of inertia.

The writers feel satisfied that the flutter is fully explained on the theory developed in the report, and that it is unnecessary to consider any further degrees of freedom in the present instance.

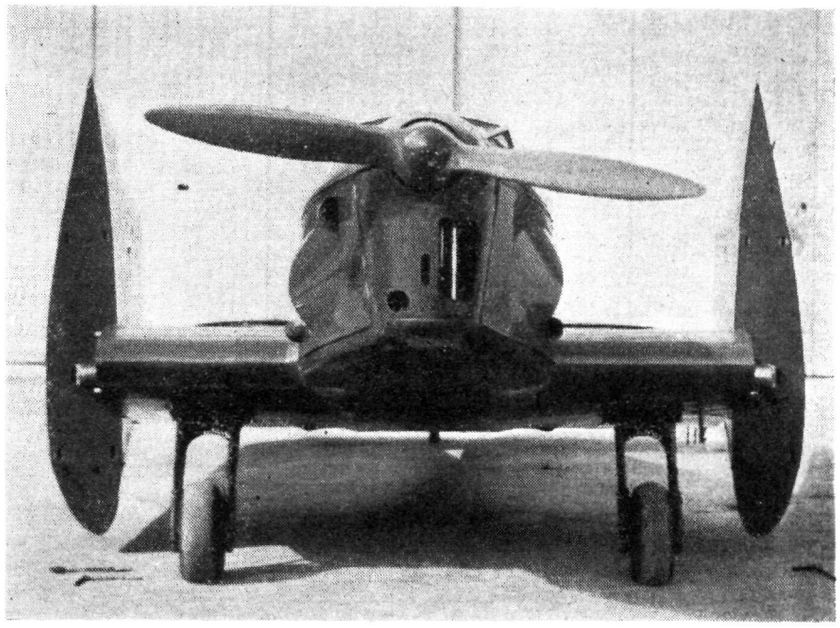
* For convenience this will be referred to as Aeroplane X.



THE COMPER "MOUSE"

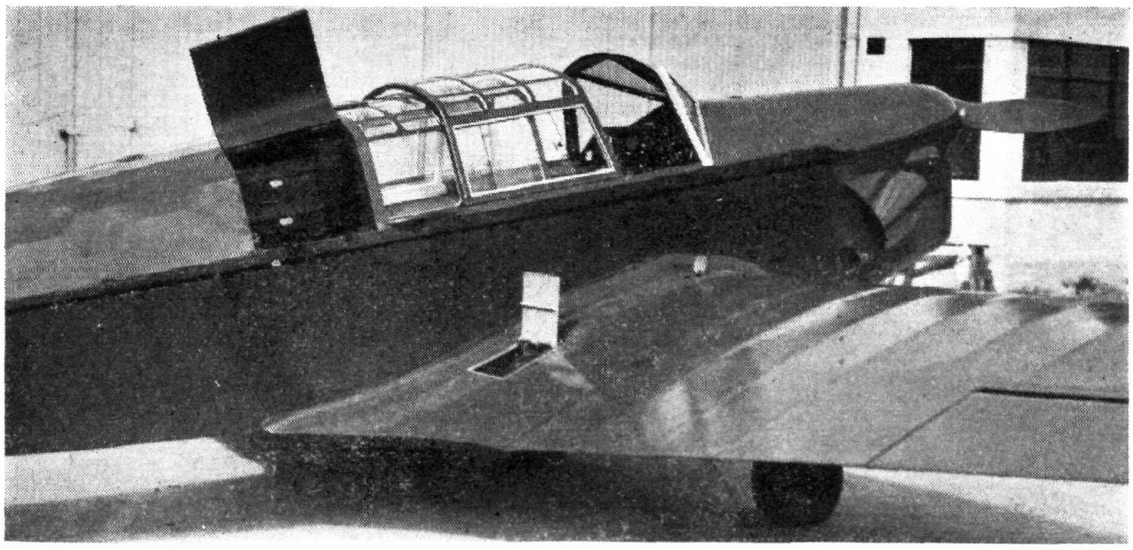
ALTHOUGH originally designed over two years ago, the Comper "Mouse," which has just been placed on the market by the Comper Aircraft Co., Ltd., of Heston Airport, and of which we are now able to give the first full details, is still a very modern layout. At the time of its first conception it was called the "Aircar," and this name is peculiarly apt, as it should fill the requirements of those who want something more than the high-speed touring car can give them. While the Comper Company was still at Hooton it was not found possible to go into production with this machine, and it is only now, when they have moved to Heston Airport, that the facilities available have been such as to warrant embarking upon its production. Naturally, during the intervening time, some detailed changes have been made in the design, but the basic layout and specification have remained the same.

The "Mouse" is a three-seater, full cantilever, low-wing monoplane, driven by a single "Gipsy Major" engine rated at 130 h.p. The low-wing arrangement has of recent years found several adherents among our designers, where a high cruising speed has been desired without the disadvantage of a high landing speed. This layout certainly benefits from a form of air-cushioning when nearing the ground, and it would appear to mitigate to a considerable extent the disadvantageous interference between the wing and the fuselage, which in some designs accounts for a poor performance.

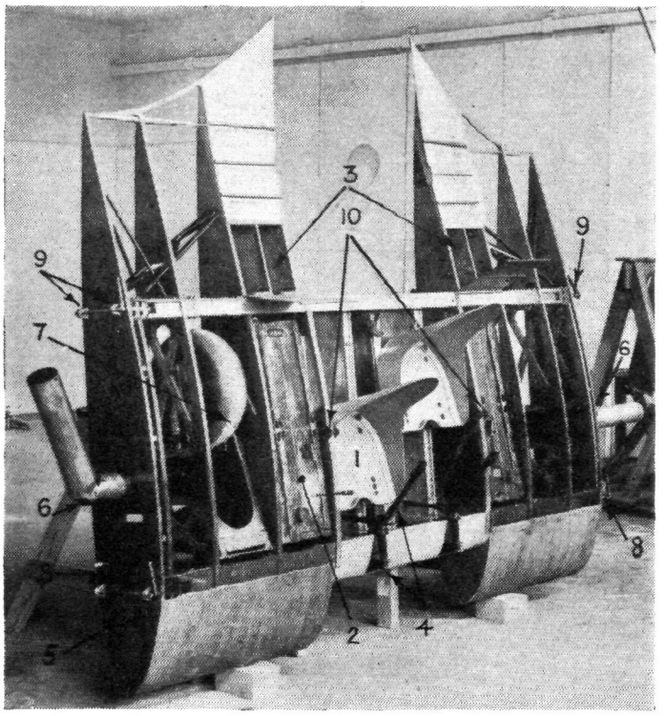


This front view, and the view above, show the neat design of the undercarriage. The clean engine cowling around the "Gipsy Major" and the small space taken by the "Mouse" when folded should be noted. (FLIGHT *Photos.*)

Flt. Lt. N. Comper's new machine is designed to cater for both the



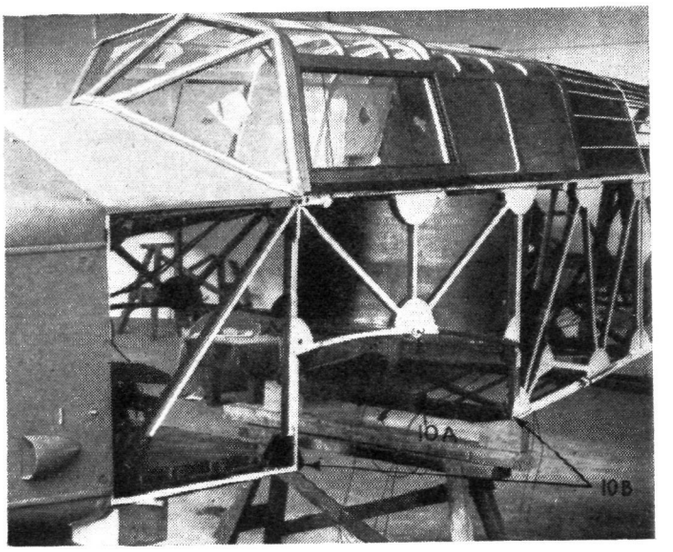
The cabin of the "Mouse" is light and airy, as it is fitted with a form of sunshine roof. The small locker in the wing root can be used for tools and log books. The luggage locker, as shown, holds three suit cases, which are supplied with the machine. (FLIGHT *Photo.*)



The centre section is built as a separate unit. 1, an adjustable seat sliding on runners. 2, the starboard wing fuel tank. 3, small lockers for tools and log books. 4, a control column, working the push-push rods which leave the wing at 5, where they end in rubber buffers. 6, the elbow joint upon which the wing folds. 7, an undercarriage wheel retracted. 8 and 9, the wing root spar bolts. 10, the centre attachment point for the fuselage. (FLIGHT *Photo.*)

private and commercial owner. The cabin is wide, allowing very comfortable seating, while at the same time providing more space for commercial pay load than is usually found. Throughout the machine there is evidence that particular attention has been paid to the demand for comfort. The luggage locker is large, holding three ample-sized suit-cases, while by an ingenious arrangement two lockers are provided in the wing roots, which are suitable for tools, log books, etc.

The seating arrangement is very comfortable. The pilot does not sit alone in front, but has a choice of sides as the two front seats, which are both adjustable on runners, face full dual sets of controls, allowing the "Mouse" to be flown from either seat. The rear seat is a very comfortably upholstered one, right across the fuselage, and would, if necessary, give sufficient room for a child to be seated alongside the second passenger. Provision is also being made for light luggage, hats and so on, to be carried in a rack behind the rear seat. Having the front seat on sliding runners permits of many variations in the seating, so that when three persons are in the machine, one, not piloting, may either be forward where he can talk to the pilot, or aft where he is near the second passenger.



The front part of the fuselage drops over the centre section of the wing and is attached by three bolts at 10a and 10b. (FLIGHT *Photo.*)

THE COMPER "MOUSE" 3 SEATER

"Gipsy Major" engine 130 H.P.

Dimensions

Total wing area	172·0 *sq. ft.*	(16 *sq. m.*).
Ailerons (included above)	24·0 ,,	(2·2 ,,).
Tailplane	20·0 ,,	(1·8 ,,).
Elevators	12·0 ,,	(1·1 ,,).
Fin	5·15 ,,	(0·5 ,,).
Rudder	8·05 ,,	(0·7 ,,).
Length	25 *ft.* 1 *in.*	(7,645 ,,).
Height	5 ,, 6 ,,	(1,676 ,,).
Span	37 ,, 6 ,,	(11,430 ,,).
Width, folded	11 ,, 10 ,,	(3,607 ,,).
Track	6 ,, 0 ,,	(1,829 ,,).

Weights

Weight, empty	1,300 *lb.*	(589·7 *kg.*).
Fuel	295 ,,	(133·8 ,,).
Payload and pilot	620 ,,	(281·2 ,,).
	2,215 ,,	(1,004·7 *kg.*).
Acrobatic weight	2,000 ,,	(907·2 *kg.*).

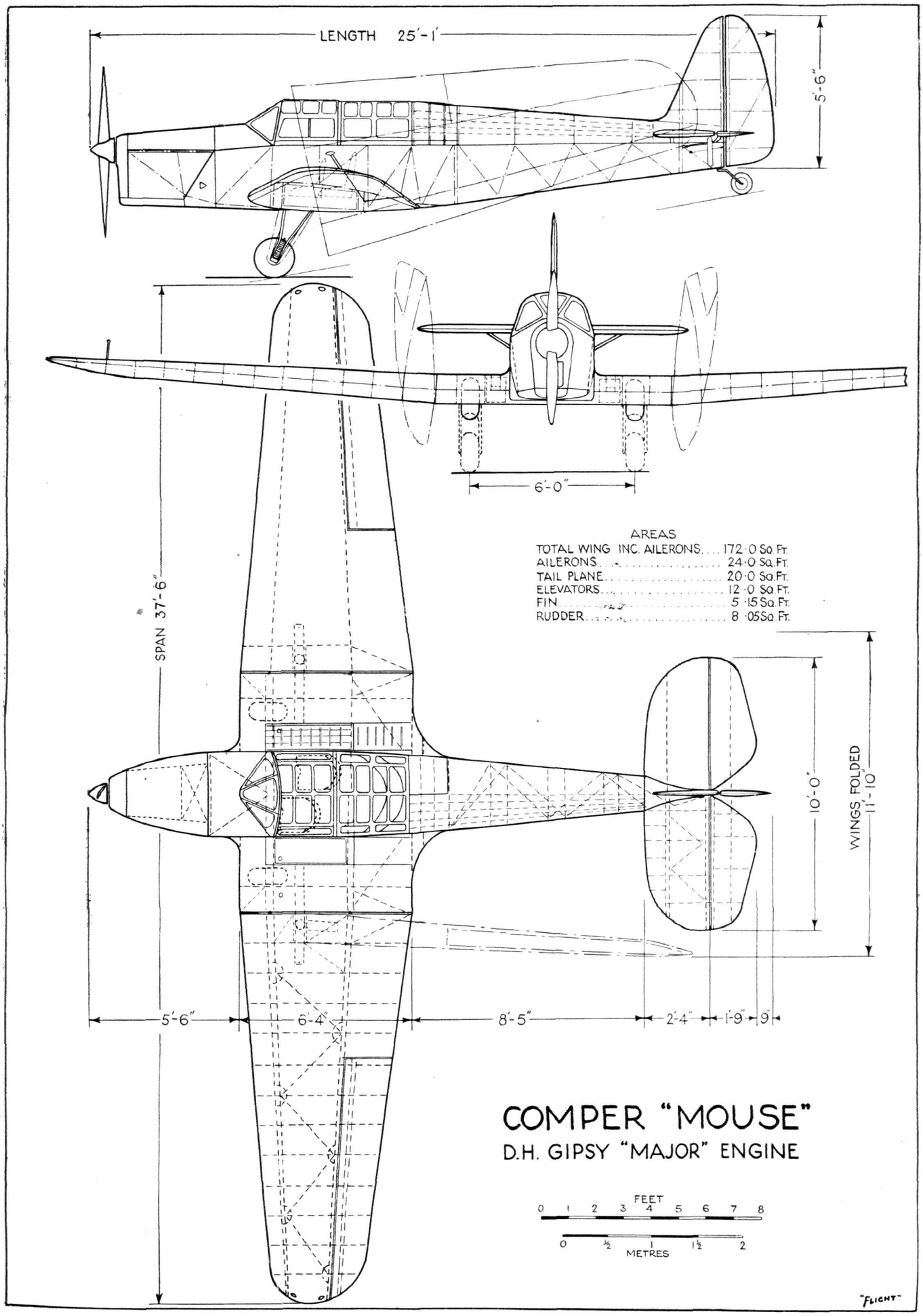
Performance (Estimated)

Cruising speed, about	130 *m.p.h.*	(209·2 *km.p.h.*).
Range	600 *miles*	(965·6 *km.*).

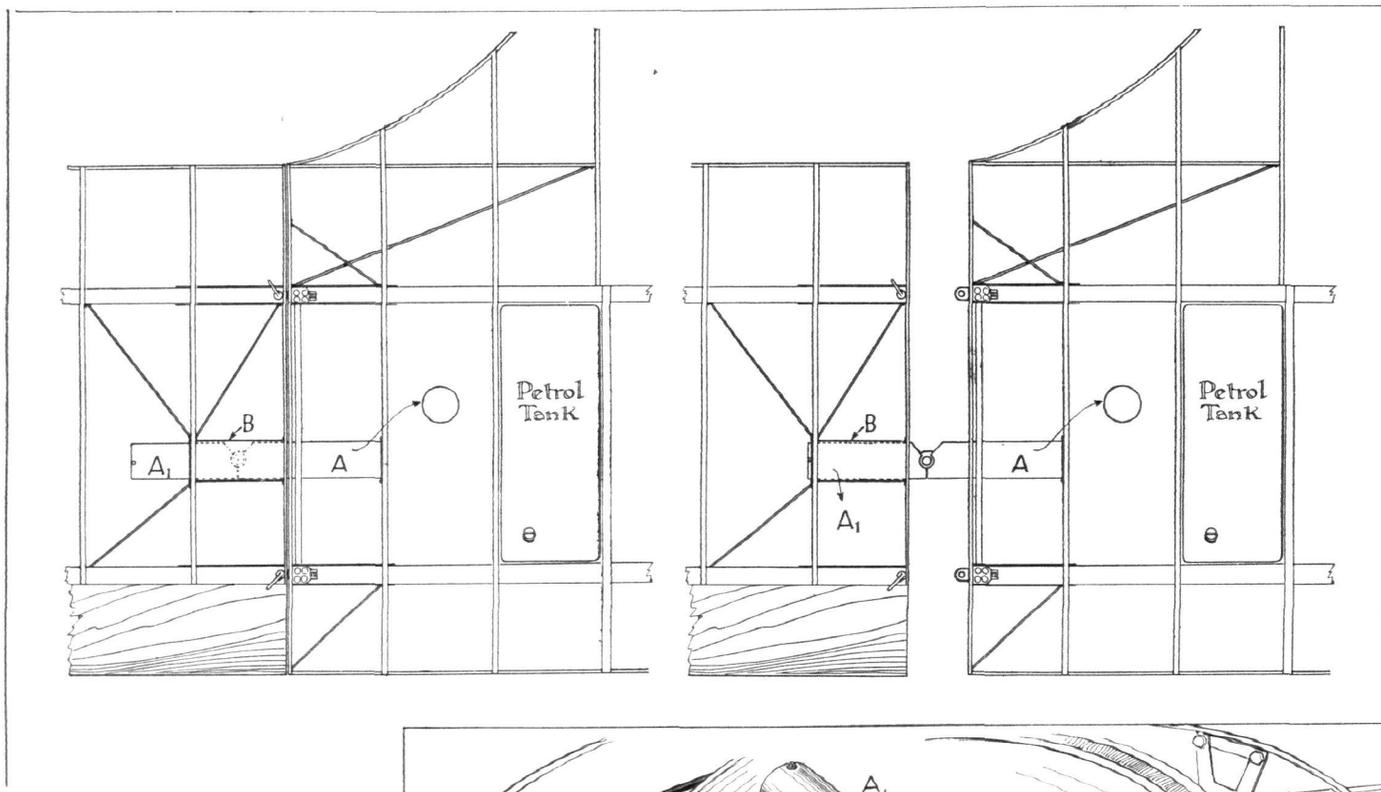
Loadings

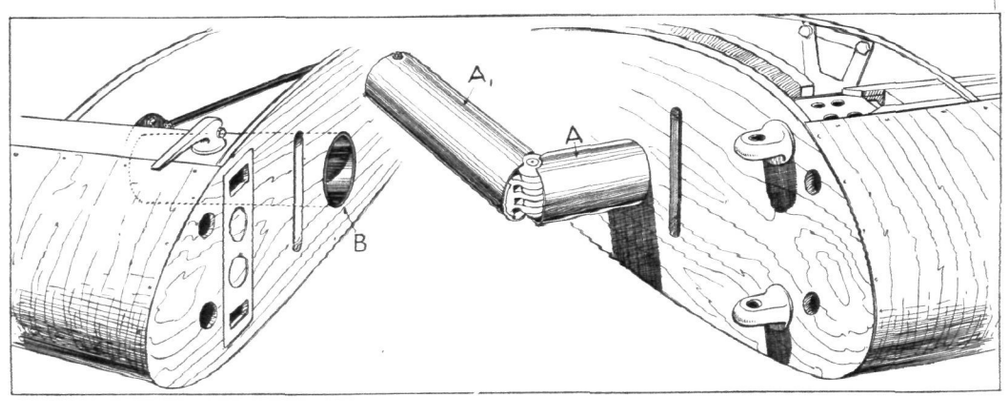
Wing loading	12·9 *lb./sq. ft.*	(62·98 *kg./sq. m.*).
Power loading	17 *lb./h.p.*	(7·7 *kg./h.p.*).

The front view emphasises the clean design. (FLIGHT *Photo.*)



THE COMPER "MOUSE": General Arrangement Drawings.

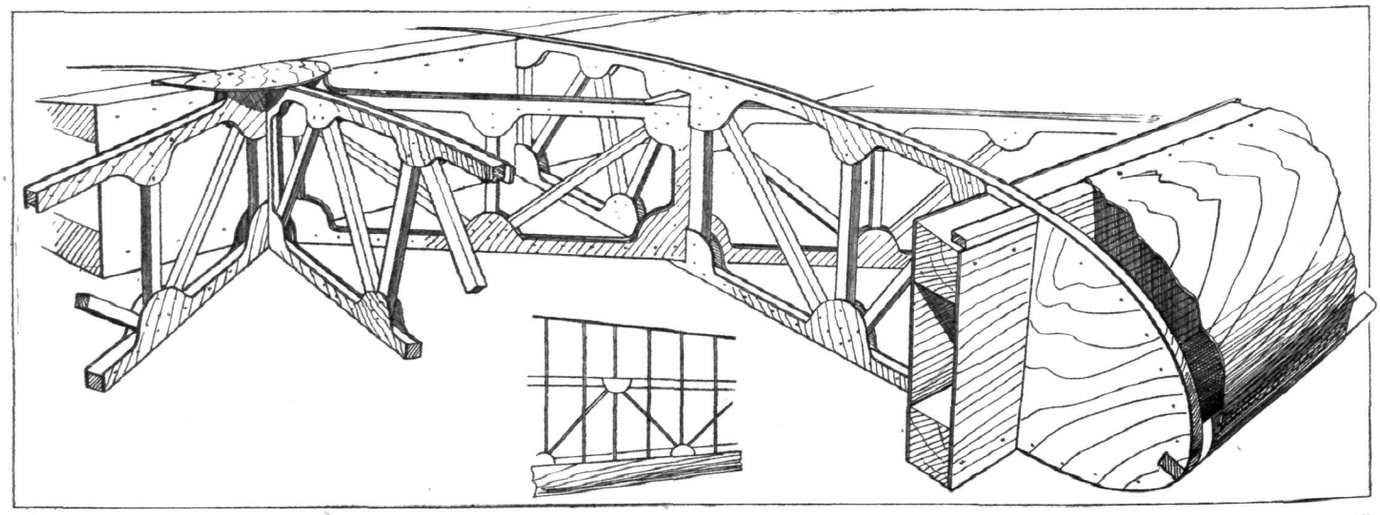




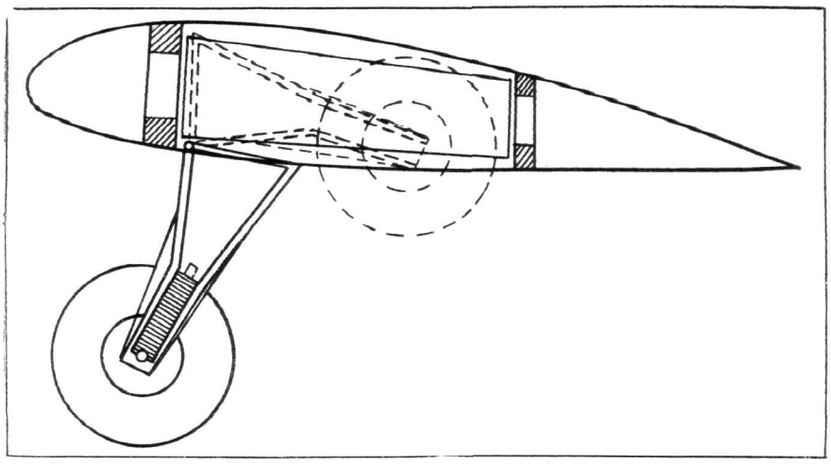
These three sketches show how the wing folds. The jointed tube A is anchored in the centre section and passes through the tube B. (FLIGHT *Sketches.*)

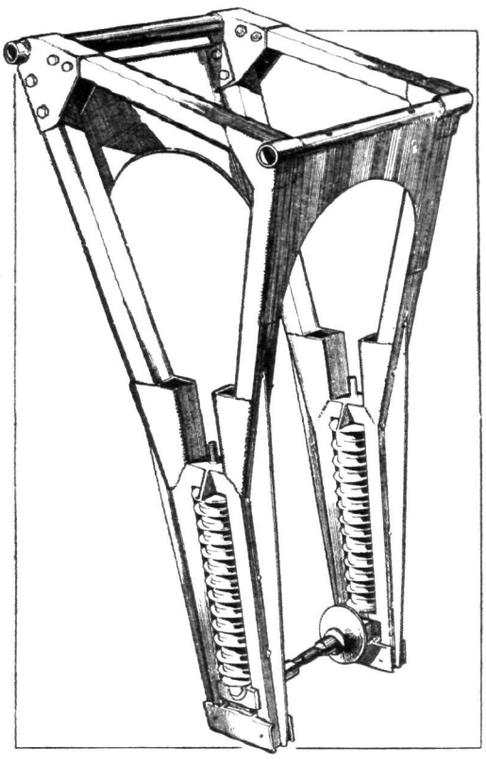
Naturally, having side-by-side seating necessitates a fairly wide fuselage, but the nose of the "Mouse" is well formed, and the cowling over the engine does not hinder the view forward when the machine is in flying position. On the ground the view for taxying is not, perhaps, ideal, but this is more than compensated for by the fact that the cabin roof is so made that it can be opened in flight. It is, therefore, a simple matter to taxy with it in the open position and for the pilot to look out over the top.

A feature which is as yet only found on the most modern machines is the retractable undercarriage. This is particularly simple, and, as can be seen from our artist's sketches, each wheel is carried in a rectangular pyramid of angle section steel. The springing is by a tier of rubber blocks above each end of the axle. This bracing, enclosing the wheel and carrying the springing, forms a separate unit for each wheel, and is hinged about its foremost edge. A lever system, worked by a hand lever in the cockpit, raises or lowers each unit in a negligible space of time. Aluminium cowling will, in the finished machine, be

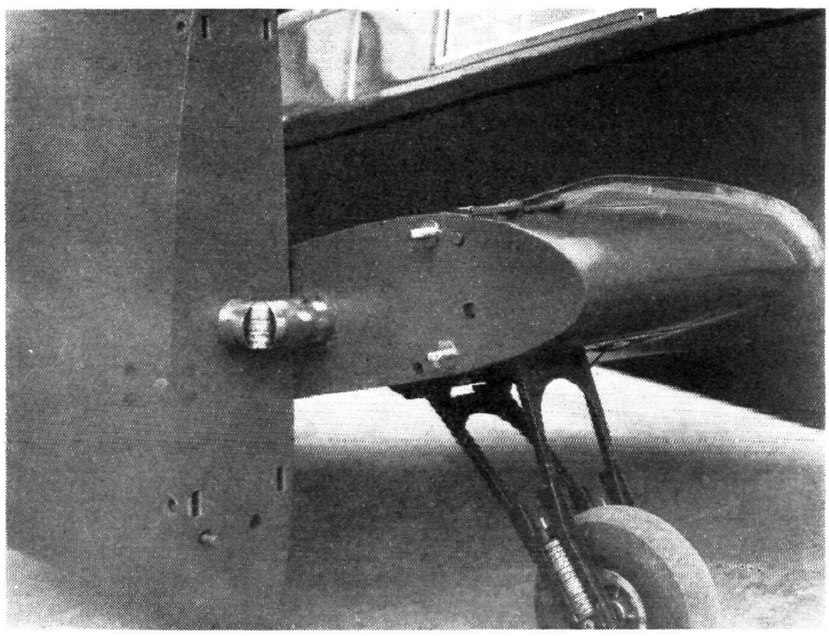


This explains the general structure of the wing. (FLIGHT *Sketch.*)





Above are details of the retractable undercarriage. (FLIGHT *Sketches.*)



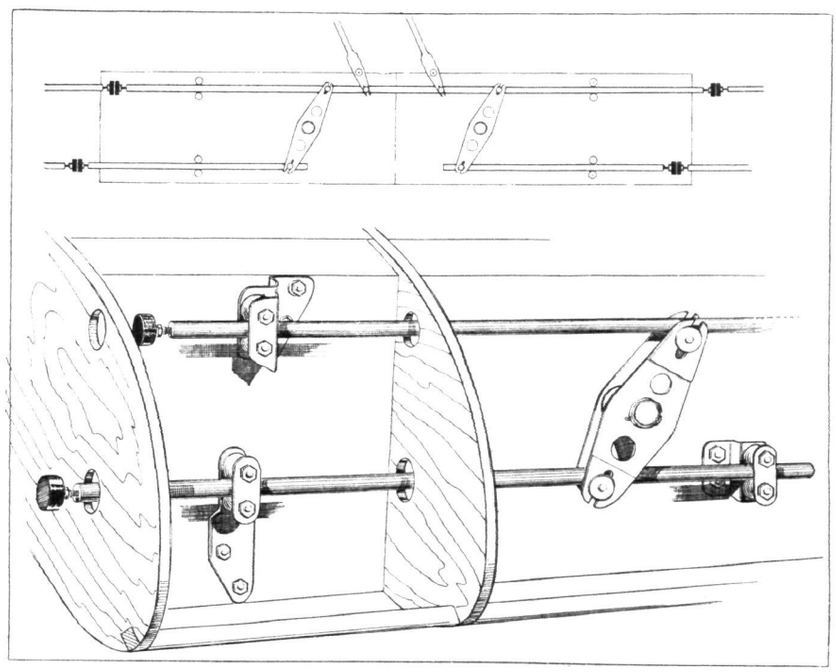
This shows the method by which the wings are folded on a central joint. (FLIGHT *Photo.*)

Below a sketch explains the action of the push-push rods for working the ailerons, while at the same time providing a system which does not have to be uncoupled when the wings are folded. (FLIGHT *Sketch.*)

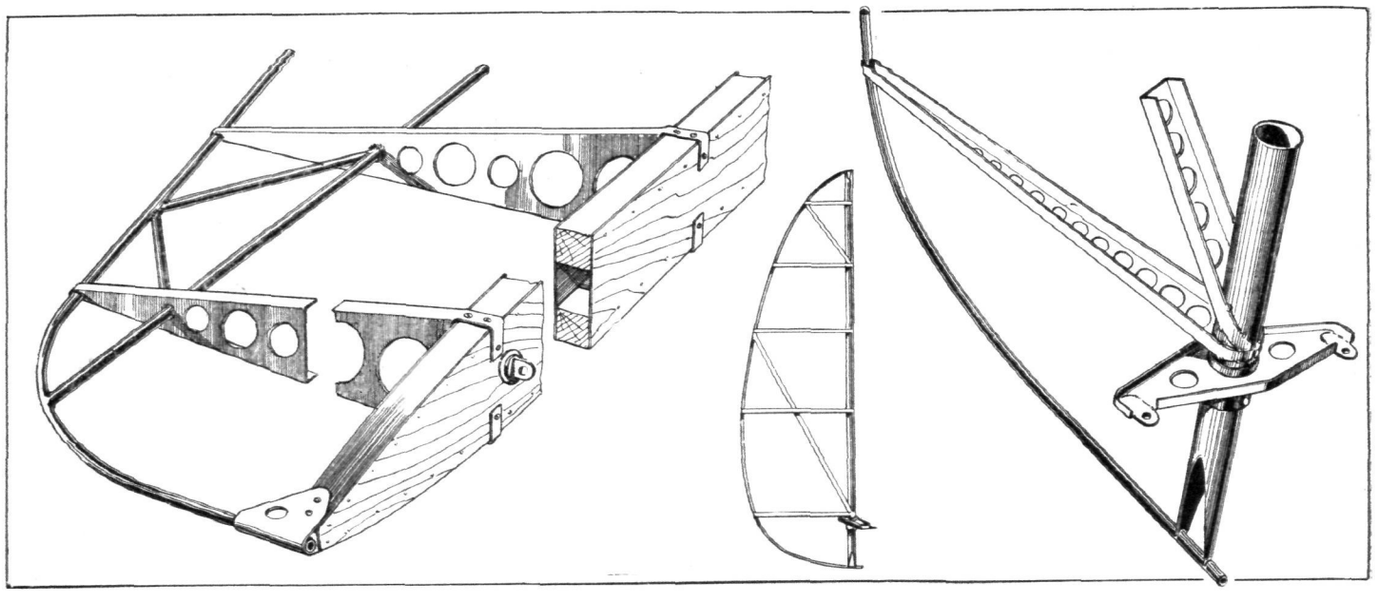
attached to the front of the wheel units, not only serving to streamline the unit when retracted, but conversely acting as an air brake when the unit is lowered.

Many aeroplanes have, of recent years, been fitted with sliding cabin tops, but little attempt has been made to design a top which would be strong enough to be opened while in flight. The "Mouse" has this desirable feature, and is, therefore, comparable to a motor-car with a sunshine roof. There is an added advantage to this in that it will allow the pilot to put his head right outside in the case of necessity, and is also strong enough to give safety to the occupants should the machine be overturned.

Structurally the "Mouse" is a straightforward wooden machine with rigid bracing. The fuselage is slab sided with fabric covering over spruce longerons and diagonal spruce bracing. It is built in three parts—the rear portion, the cabin section, and the engine bay. Plywood or steel plate "biscuits" of generous dimensions are used on each side of all fuselage joints where bracing struts come to the longerons. It will be seen from our photograph that in the forward part of the fuselage the bottom longeron is cut away so that the fuselage will drop over the bottom centre section of the wing and mate up with three attachment points, two on the longeron and one on a braced point in the centre of the bay bracing above.



This wing centre section is interesting, as it is a separate unit and contains many special features. The two front seats are carried on runners between the spars, with the control columns in front of them attached to the front spar. Outside each seat there is a wing fuel tank of nine gall. capacity, and outside that again, still between the spars, is the space wherein the retracted undercarriage lies. The wing root is also unusual. The outer portion of the wing is attached to the spar roots by two screwed bolts which can readily be withdrawn



The tail plane on the left has a boxed wooden spar with steel ribs. The rudder on the right is all steel. (FLIGHT *Sketch.*)

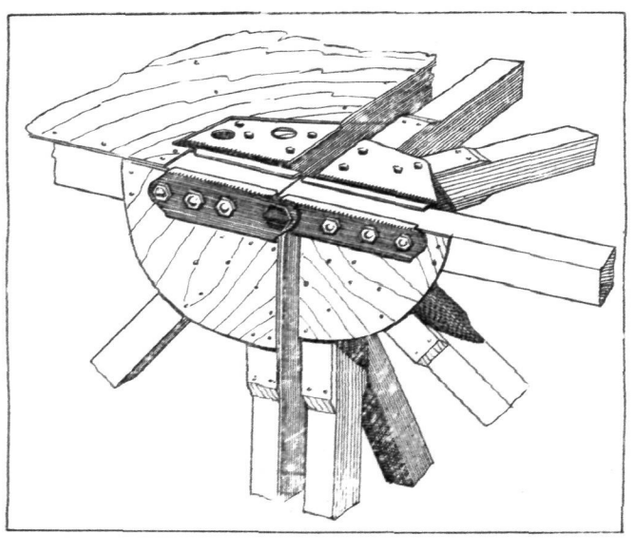
when unscrewed by means of the folding head on each. In the middle of the aerofoil section is a large-diameter tube with an elbow joint in it. The inner half of this tube is rigidly attached to the wing centre-section, and the outer part of the wing slides over the outer part of the tube. The procedure when folding the wings is, after removing the wing bolts, to pull the wing out on the large tube, rotate it until the leading edge is downwards and then fold backwards.

The wing spars are boxed up of spruce booms and plywood webs, while the ribs and the bracing are simple N or Warren girder trusses, of spruce and plywood. The leading edge is plywood covered and the remainder of the wing fabric covered. The ailerons are of the same construction, as is the tail plane, except that the latter has a tubular leading edge. The elevators have boxed wooden spars, with angle steel ribs and tubular bracing and trailing edges. The rudder is on a steel post with steel ribs welded to it and a tubular trailing edge. The tail wheel, which is free to swivel, is a small rubber-tyred wheel, carried in a spring-steel fork.

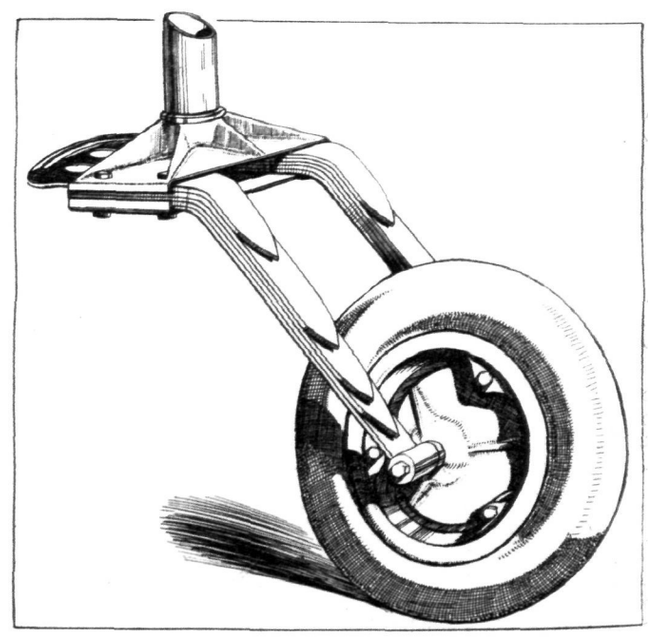
The engine is carried on a welded-steel tube mounting carried from four bolts at the front end of the fuselage. Besides the wing fuel tanks, there is a 14-gall. gravity tank in the front of the fuselage The engine cowling is so arranged that the engine is perhaps more accessible than in any light aircraft we have seen. The side panels of the cowling, which are of well reinforced aluminium sheet, are hung on vertical hinges at the front ends. These can be swung forward and locked with a strut, while the bottom of the cowling can also be lowered on a transverse hinge, thus exposing all the features of the engine which require attention.

The control system for the ailerons is worthy of especial note. This is by means of what may be termed push-push rods. At the point where the rods leave the centre section and enter the wing proper, they are broken and ended with rubber buffers. Two rods lead to each aileron, running between closely-spaced rollers. The buffers provide a means whereby the wing may be folded without in any way disturbing the aileron control mechanism.

As the "Mouse" has not yet finished its full flying trials, it is not yet possible to quote actual performance figures. Actually, these have come out very satisfactorily, and there is every indication that they will surpass the estimated ones. The cruising speed, it is hoped, will be about 130 m.p.h., while the landing speed and take-off run are remarkably low and short.



A fuselage joint between the rear portion and the cabin ; large plywood biscuits and steel fish plates are used. (FLIGHT *Sketch.*)



The tail wheel mounted on a spring steel fork. (FLIGHT *Sketch.*)

Save time by using the Air Mail.

Air Transport.

TENDERS FOR SINGAPORE—AUSTRALIA AIR MAIL

TENDERS for the Singapore-Darwin section of the England-Australia air mail service, and for certain internal connecting services in the Commonwealth, were called on September 23 and will close in Melbourne on January 31, 1934. The Australian Minister in London (Mr. S. M. Bruce) has received by cablegram from Melbourne the following particulars of the services and the conditions governing the tenders:—

The contract period for the services for which tenders are invited is five years, and thereafter until three months' notice is given by either party.

The services will be in three divisions, namely:—(1) Overseas division from Singapore to Darwin; (2) Eastern division from Darwin to Charleville and Brisbane, and Charleville to Cootamundra; (3) Western division from Katherine to Perth. Separate tenders may be made for the whole or any division. Alternatively, or in addition, separate tenders may be made for each and every combination of separate sections either Eastern or Western division, provided that any combination of separate sections tendered for shall include only connecting sections. Alternatively, or in addition, separate tenders may be made for any one or more separate sections of either Eastern or Western division as tenderers may wish. The sections are:—On Eastern division, Darwin-Isa; Isa-Longreach; Longreach-Brisbane; and Charleville-Cootamundra; on Western division, Katherine-Broome; Broome-Carnarvon; and Carnarvon-Perth.

All aircraft must be of Empire manufacture and possessing type certificates of airworthiness at the time of consideration of tenders, and must have undergone Martlesham or other acceptable official airworthiness and performance tests.

Tenders may be submitted based on aircraft with a cruising speed of not less than 95 m.p.h. for the first two years, to be replaced then for use in third, fourth and fifth years by aircraft with a cruising speed of not less than 110 m.p.h., or alternatively, aircraft with a cruising speed of not less than 110 m.p.h. for the whole period of five years. If first alternative is adopted, tenders need not specify actual type of aircraft to be used during the third, fourth and fifth years. Cruising speed is defined at 85 per cent. top speed.

Contracting companies must be incorporated in Australia, with directors and shareholders 100 per cent. British subjects. Aircraft must operate under Commonwealth certificates of registration and airworthiness, and pilots, navigators, wireless operators and ground engineers must have Australian licences.

For overseas division aircraft must be multi-engined, capable of maintaining a level flight at 2,000 ft. with one engine cut out when carrying not less than the minimum load specified hereafter, and must have a cruising range of not less than 600 miles against 30 miles headwind. For internal services the machines need not necessarily be multi-engined, but must have a cruising range of not less than 300 miles against 30 miles headwind.

Aircraft must have the following minimum pay load capacities, exclusive of weight of crew, instruments, equipment, spares and fuel and oil for ranges as above:—Overseas division (Singapore-Darwin), not less than 1,055 lb., including provision for not less than three passengers; Darwin-Isa and Isa-Longreach, 1,425 lb., including provision for five passengers; Longreach-Brisbane, 1,980 lb., including provision for eight passengers; Charleville-Cootamundra, 1,005 lb., including provision for three passengers; Katherine-Broome, 840 lb., including provision for four passengers; Broome-Carnarvon, 1,260 lb., including provision for six passengers; Carnarvon-Perth, 1,655 lb., including provision for eight passengers.

Minimum requirements are specified for aircraft wireless equipment on overseas service, and for wireless for emergency use on ground for Darwin-Isa and Katherine-Broome services.

Services will be once weekly in each direction via stopping places as specified, but the Commonwealth may require the contractor to perform extra trips when necessity arises. Time-tables are to be determined by the Commonwealth in the light of speed of aircraft accepted for services, but based on six-day transit from Singapore to Cootamundra for aircraft in the vicinity of 95 m.p.h., and five-day transit for aircraft in the vicinity of 110 m.p.h.

Contractors are required to accept all mail offered by the Commonwealth. Mails are to be conveyed in a suitable and secure place, and contractors are to be fully responsible for all loss or damage to mails.

Passengers must be accepted as offering, subject to mails having first preference when loading aircraft within the limits prescribed by certificate of airworthiness. No passengers will be carried on the Singapore-Darwin service until the service has operated satisfactorily for three months.

Contractors are to maintain in airworthy condition throughout period of contract aircraft of the type and to the number specified in tenders, and subsidy rate will be reduced proportionately if they fail to do so. Aircraft types other than types tendered for are not to be used except with the prior approval of the Commonwealth. Aircraft are to be certified daily fit for flight by licensed ground engineers.

Tenderers are to specify the minimum number and location of spare engines, minimum value of spare parts, and the minimum number and location of pilots and ground engineers to be maintained throughout the contract period. All licensed pilots, ground engineers, navigators and wireless operators are to be British subjects of British race, and all other employees to be British subjects unless no British subjects are available for the work concerned.

The services are to commence on dates specified by tenderers, or on such other date to be determined by the Minister to ensure co-ordination of commencement of all services. The Minister may withhold the subsidy in respect of any trip delayed more than 24 hr. beyond contract time-table, except where such delay is caused by delay on another connecting service. The usual clause for breach of contract enables the Minister to terminate contract, or, alternatively, to deduct up to £100 as liquidated damages in respect of any such breach. Contractors are to be paid subsidy at rate per mile tendered for contract trips, and at rate per mile tendered for extra trips based on airline distances specified in contract conditions. If and whenever mail loading aggregates a greater poundage than 13,000 lb. per quarter on overseas division (Singapore-Darwin), and between any two stopping places on eastern division, or greater than 5,200 lb. per quarter between any two stopping places on western division, the Commonwealth will make extra payment on the basis of one penny per pound weight of such excess loading for each 100 miles over which excess loading is carried. This extra payment applies to contract trips only. The quarterly periods commence from date of inauguration of the service, and consist of 26 contract trips per quarter.

Contractors are required to refrain from joyriding activities with contract aircraft at such centres as the Minister may notify. The contractor may land and depart from Commonwealth aerodromes free of charge, but shall pay the prescribed landing charges at other aerodromes. The contractors are to provide all hangars, etc., required, and pay prescribed charges for rental of allotments on Commonwealth aerodromes for purposes of erecting such buildings. The Commonwealth has the option of purchasing such buildings at the end of contract. Commonwealth officers are to be conveyed free of charge for inspection of any matter affecting the service.

The crew for the Singapore-Darwin service shall be not less than two pilots, one licensed navigator and one certified wireless operator.

Contractors must prove to the Commonwealth that adequate arrangements are being made to ensure the commencement of the service on the appointed date, failing which the Commonwealth may cancel the contract or require the contractor to pay damages in such sum as the Commonwealth requires. The Commonwealth has power

to make separate arrangements for the performance of any trip if in doubt as to the contractor's ability or intention to undertake such contract trip.

The contract stopping places are:—For the overseas division, Singapore, Batavia, Sourabaya, Ranbang Aerodrome on Soemba Island, Koepang and Darwin; for the eastern division, Darwin, Katherine, Daly Waters, Newcastle Waters, Anthony's Lagoon, Brunette Downs, Alexandria, Camooweal, Mount Isa, Cloncurry, McKinlay, Winton, Longreach, Blackall, Tambo, Charleville, Roma, Toowoomba, Brisbane, and Charleville, Bourke, Narramine and Cootamundra; for the western division, Katherine, Victoria River Downs, Wave Hill, Ord River, Hall's Creek, Fitzroy Crossing, Noonkanbah, Derby, Broome, Hedland, Whim Creek, Roebourne, Onslow, Carnarvon, Geraldton and Perth.

Copies of tender forms and detailed conditions of tender are being forwarded by air mail, and will be available at the office of the High Commissioner, Australia House, Strand, at an early date.

CIVIL AVIATION IN CANADA

INFORMATION in this country regarding civil aviation in Canada is inclined to be a trifle vague, and what reports have drifted across the Atlantic appear to have been none too encouraging. Mr. J. A. Wilson, Controller of Civil Aviation in Canada, who is at present in England, assures us, however, that much constructive work is being done by the Government, and a sound foundation is being laid upon which can be built, easily and quickly, as soon as the financial resources of the country warrant the necessary expenditure, a successful industry.

In the year following the war aviation aroused a great deal of interest in Canada, and many ventures were inaugurated, generously backed up by a far-seeing Government. Clubs sprang into being, and mail and passenger services were started, connecting up most of the large towns. Flying Clubs were subsidised and within the space of two years a perfect network of clubs was scattered about the country. Mail services were started, and, with the assistance of the Post Office, spread across the width of the continent. By 1928-29 twenty-four hours had been cut off the time taken by mails to cross Canada, and a lighted airway stretched across the 1,300 miles between Winnipeg and the Rocky Mountains. Then came the slump and the ensuing necessity for stringent economy. Faced with a situation which, as in most other countries, looked like developing into a national crisis, the Canadian Government was forced to put into effect drastic economies, and aviation was probably the greatest sufferer. Later on, when conditions started to show signs of slight improvement, the Government once more turned its attention to aviation. In the year 1931 the Government, working on the unemployment relief scheme, started to construct landing grounds, and in a year's time over 100 had been completed, for the most part on the trans-continental air mail route.

At the present time there is only one air line in Canada which operates a really extensive regular programme; that is Canadian Airways, Ltd. This company is not subsidised by the State, but flies for the Post Office under contract. The only subsidised flying in Canada is that done by the clubs, subsidy being paid to them at a rate of so much for every pilot trained. In fact, Canada is one of the few countries where mails are not the chief item of remuneration to a company operating air lines. Mr. Wilson states quite definitely that if air transport, and in particular air mail transport, is to come into its own, it must prove itself to be as reliable as railways and at least 50 per cent. quicker. Air mails must also be flown during the night, for otherwise they cannot expect to compete with an excellent train service for which the darkness is no impediment.

Turning to the subject of a transatlantic air service, Mr. Wilson said that there was one fact which seemed to escape the notice of most people; the distance between Liverpool and Montreal is just over 3,000 miles; the distance between Liverpool and St. John's, Newfoundland, just about 2,000 miles, which means that a third of the total distance, namely, that between Newfoundland and Montreal, could be safely traversed by air transport flying over the land practically the whole way, which would represent a saving in time of just about a whole day.

A few statistics will not be out of place to show that aviation in Canada is not as dead as most people seem to think. The total number of club members carrying on dual instruction exceeds 10,000; the total amount of freight carried during 1932 was 3,129,974 lb., which compares very favourably with 2,372,467 lb. of 1931 and 1,759,259 lb. of 1930. The amount of mail carried during the same year was 413,678 lb., which shows a slight decrease on the figures of the two preceding years, which only tends to prove what has been mentioned above that mails are of secondary importance.

The policy of the Canadian Government during the last few years has been to keep aviation alive by judicious nursing of ground equipment, such as landing grounds, beacons, wireless, etc., so that when the time arrives for the further promoting of aviation all will be ready.

When questioned about the types of machines used in Canada, Mr. Wilson admitted that German and American machines were used more extensively than British, but it was the policy of the Government to use Canadian products first, British second, and American third, providing the goods were on the market. The Junkers machines had proved very efficient in the past, and if British machines had been available which were as suitable for the particular jobs, at the same cost, the Canadian Government would have come to England to buy. The D.H. "Moth" and the D.H. "Dragon" were machines which were eminently suited for flying in Canada, and these machines had been purchased, the former in large quantities and the latter as supply demanded.

Spartan Cruisers for Jugoslavia

AT Cowes Aerodrome, on September 19, the first of a number of Spartan "Cruiser" aeroplanes ("Gipsy Major"), illustrated below, constructed for the Société de Navigation Aerienne "Aeroput" of Belgrade, Jugoslavia, was formally accepted by their Chief Technical Representative, Mr. Mitrovitch. Before a signature was obtained to the delivery note, the machine was thoroughly inspected by him, and test flights were made at an all-up weight of 5,700 lb. He expressed his complete satisfaction with the machine. This order was obtained in the face of very keen British and Continental competition—in fact, representatives of a foreign air ministry were actually sent out to Jugoslavia when it was known that "Aeroput" were purchasing new aircraft. The Spartan "Cruiser" was chosen because of its extremely robust construction, its good all-round performance, and the great safety factor of its three-engined installation. The Chief Test Pilot of Spartan Aircraft, Ltd., Lt. Col. L. A. Strange, demonstrated the ease with which the machine at full load would maintain height at over 6,000 ft. on any of the two engines, and that it could cruise comfortably at 118 m.p.h. We understand the high standard of the interior finish and equipment, which was supplied by L. A. Rumbold & Co., Kingsgate Place, Kilburn, London, N.W.6, particularly pleased the purchasers.

Airisms from the Four Winds.

The Lindberghs in Russia

COL. CHARLES LINDBERGH and his wife flew from Karlskrona, Sweden, to Helsingfors, Finland, on September 20. On September 25 they alighted on the River Moskva, having flown across from Leningrad. Col. Lindbergh is reported to have persuaded A.B. Aero Transport to place an order for a fast American machine to be placed on the Stockholm-London route (the Scandinavian Air Express).

Pinedo's Funeral

THE funeral of the Marquis de Pinedo took place in Rome on September 21 with the ceremonial befitting the occasion.

From Harley Street to India

THE two doctors who left England on Sunday, September 17, to fly to India in order to operate on the wife of the Crown Prince of Nepal, arrived at Ahmedabad on Monday, September 25. From there they will continue their journey to Bombay by rail.

Byrd off Again

REAR-ADMIRAL RICHARD BYRD'S expedition left Boston in the barquentine *Bear of Oakland* and the steamer *Jacob Ruppert* a few days ago *en route* for Byrd's old base, "Little America," in the Antarctic. The expedition, which is expected to arrive at its base around Christmas, has taken with it a twin-engined aeroplane and an "Autogiro."

Balloon Items

THE GORDON BENNETT BALLOON RACE, held in America, was won by the Polish balloon, *Kosciluszko*, piloted by Capt. F. Hynek and Lt. Z. Burzynsky. The distance covered was 846 miles. Great Britain was not represented.

A GERMAN balloon which left Düsseldorf on Saturday, September 23, was blown ashore at Berwick-on-Tweed next day, after having crossed Denmark and then been blown from the Norwegian coast across the North Sea. The occupants were Dr. Dieckman, Herr Baume, and Dr. Wagner. As the balloon bumped over the sea wall at Berwick, Dr. Dieckman fell out and was injured. He was taken to hospital. The other two were unhurt, and returned to Germany on September 25. The injured doctor is expected to be well enough to travel in a few days.

A SOVIET balloon which was intended to try to beat the altitude record set up by Prof. Picard was to have made its ascent from Moscow on Sunday, September 24. The aeronaut was M. Prokofieff. A thick mist deposited a lot of moisture on the envelope, and there was no sun to dry it. As balloons intended to rise to great heights must start with only a comparatively small quantity of gas, this balloon refused to rise, and the attempt was abandoned for the day.

Wiley Post Injured

WILEY POST was severely injured when the *Winnie Mae* crashed at Quincy, Ill., on September 21. Fuller details are not available.

The Flying Boats' Return

THREE of the four "Southampton" flying boats of No. 204 Squadron (Napier "Lion" engines) have returned from their cruise to Finland, and are back at their base at Mount Batten. The fourth boat is waiting at Reval for certain spare parts before making its return flight. The boats have kept their prearranged time-table to within a few hours during the whole cruise.

A "Windhover" for Ireland

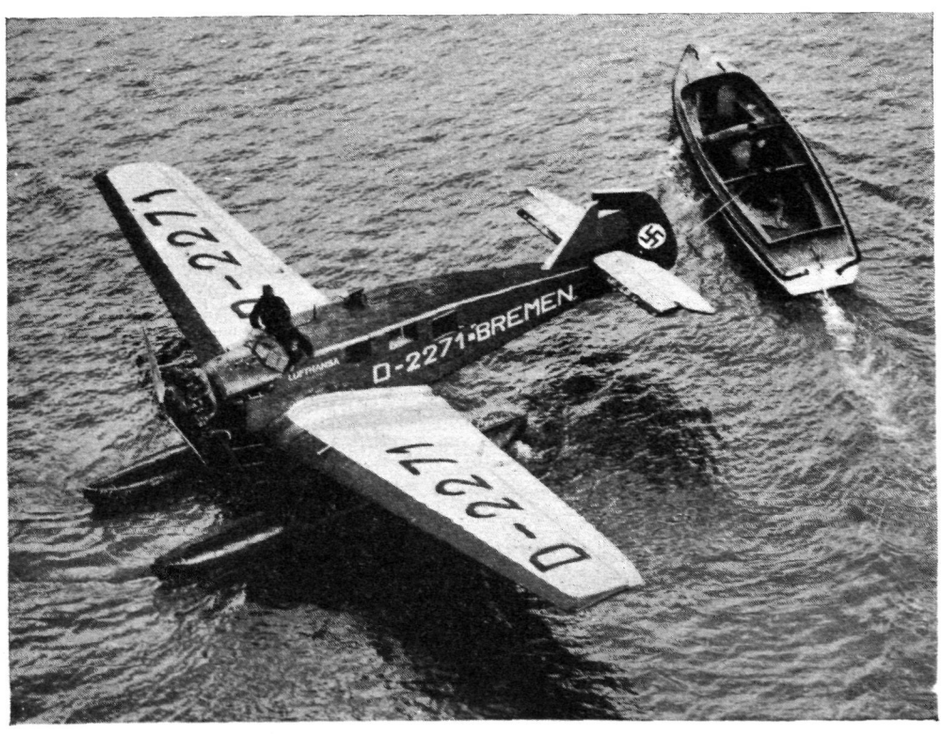
LAST week Mr. John Lord, the managing director of Saunders Roe, Ltd., flew in a Saro "Windhover" to Dublin accompanied by Capt. Scott. The machine was demonstrated to a party of officers of the Free State Army Air Corps at Baldonnel aerodrome, and it is understood that the Department of Defence is considering the purchase of a machine of this type. At the present time the Army Air Corps has no flying equipment for naval work. It is believed that if this amphibian is purchased it will be used in conjunction with the fisheries protection cruiser for spotting foreign trawlers operating within Free State territorial waters.

New Russian Air Chief

JOSEPH UNSLICHT has been appointed chief of the civil aviation administration in place of Baranoff, who was killed in an air accident recently.

Indian Air Mail

THE Postmaster-General announces that, commencing with the mail leaving London on Saturday, September 23, the England-India Air Mail service has been extended on to Rangoon. The mail will be due to reach Rangoon on Sunday evening eight days after despatch from London, a saving over the ordinary mail of 11 days. Starting on October 2, the homeward mail will leave Rangoon each Monday and be due to reach London on the following Monday. Letters by air to Rangoon should be marked "By Air in India." The postage is: First half ounce, 8d., each additional half ounce, 7d.; post cards, 4d.



LOST AND FOUND: After being catapulted from the German liner *Bremen*, with mails from America, at 11.30 a.m. on September 21, Herr Gruetering, the pilot (together with a mechanic and wireless operator) was due at Southampton by 7 p.m. He failed to arrive, and a wireless message being received from the pilot stating he was running short of fuel (having lost his bearings), ships and aircraft were sent out to make a search, but without success. Gruetering meanwhile had landed alongside a French trawler, off Ushant, which took him in tow towards England. Early next morning the Junkers seaplane was able to take off and fly to Southampton, where it arrived, as depicted in our illustration, shortly after noon.

Airport News.

CROYDON

ON Thursday last Imperial Airways, Ltd., won fame in an unusual element—the water. In the "Croydon business houses swimming competition" a team of six Imperial Airways' employees won the cup for the second year running. Those competing were O. P. Jones, the famous bearded pilot, and Messrs. Langtry, Rabbits, Cain, Cole and Kearton, the latter being a Cambridge swimming blue. New laurels were added this year by a ladies' team selected from "Imperial" Croydon employees, the Misses Tovey, Tracey, Wilkinson and Finlay, who won the ladies' event in the same competition. It is announced that Mr. R. A. Jahn, the popular Croydon Manager of Deutsch Luft Hansa, is to take up the corresponding duties in Paris on October 1. He is being replaced at Croydon by Mr. Schmidt-Rex, who has been at the head office of German Air Lines, Berlin, for ten years. Previously he spent eight years in America and Canada, working for a considerable time for the Canadian Pacific Railway. Mr. Jahn, who has been close on seven years at the Airport of London, has made many close friends. He was in the Imperial German Navy and has served as an officer on board Zeppelins. Mr. Jahn has the typical sailor's appearance and manner, and his hearty good fellowship has endeared him to all who have known him. The good wishes of the Airport of London will go with him to his new position. A visitor which made the old stagers rub their eyes was the Handley Page "W.10" G-EBMR, which did some stout work on the air routes in the past. It was piloted by its present owner, Sir Alan Cobham, and is now a flying "tanker" for refuelling the Airspeed "Courier" which Sir Alan also owns. The "Courier" is at Portsmouth, to which city G-EBMR flew from Croydon. The "W.10" is now fitted with wheel brakes, and the cabin is almost completely filled with fuel tanks.

The Prince of Wales's Vickers "Viastra," piloted by Flt. Lt. Fielden, who was accompanied by Mr. Jenkins, also visited the airport during the week for wireless tests. Mr. "Jerry" Shaw, of the Asiatic Petroleum Co., flew the firm's "Monospar" to Amsterdam and back. A quaint air visitor was Mr. Arie In'thol, a Dutch ex-Sergeant of Marines, 90 years of age, to whom K.L.M. gave a complimentary return ticket, Rotterdam-London and back. His last visit to England, 70 years ago, was made in a wooden ship. The old man's vitality was intense, and before leaving for Holland he insisted on reciting some English verses, with flashing eyes and appropriate gestures. To this veteran 500 miles' flying before tea time was a mere break in the monotony of a pensioner's life.

On Friday, the Imperial Airways' machine from Brussels, being full, Sir Ernest Oppenheimer, with his son and two of his secretarial staff, booked a special Westland "Wessex" from Sabena and flew to London. Amongst K.L.M. travellers to Hamburg was Sir Henry Deterding and Sir John Simon, while Capt. Anthony Eden travelled to Paris by Imperial Airways. A lighter note was struck by the appearance in the Main Hall, outward bound to Paris, of Miss Anita Nielson, known as Warner's baby star, who sported the latest thing in divided trouser skirts. Mlle. Lenglen was also seen at the airport, but not wearing her famous tennis skirt-shorts. A queer cargo by Luft Hansa from Berlin consisted of two vipers in a paper parcel. When the package was opened they gave no sign of life, but when prodded they stirred ominously. They were hurriedly re-packed and swiftly delivered.

At the end of the week two experts on ground traffic problems came in by D.L.H. from Berlin. They came at the invitation of the London Board of Transport to study the handling of week-end traffic here. They represented the Berlin Transport System.

Passenger figures for September this year have exceeded all expectations, and have beaten all previous records. 8,121 passengers passed through the airport up to Saturday night, September 23, the total to that date exceeding that of the whole of September, 1932.

Herr Richard Tauber, the well-known tenor, arrived by K.L.M. from Holland during the week.

The recently-formed air transport company, International Airlines, has ceased activities. It is reported that efforts will be made to form a new company to carry on the work.

A. VIATOR.

FROM HESTON

THE British Air Navigation Company, in conjunction with Misr-Airwork S.A.E., carried out a remarkable press flight early last week in connection with the funeral of H.M. King Feisal in Iraq. Mr. Mahony, of Misr-Airwork S.A.E., left Almaza Airport, Cairo, in a "Puss Moth" on September 14 at 2.30 p.m. (local time), three hours after receiving telephoned instructions from London, and arrived at Jericho at 5 p.m. He left the next morning for Baghdad, where he arrived at 10 a.m. The photographs were not ready until midnight, and he left on the return flight at 4.30 a.m. G.M.T., and reached Almaza at 2.30 p.m., after one hour's delay refuelling *en route* and one forced landing with a choked jet, less than 5 min. after Capt. Styran and Mr. Morton, of B.A.N.C.O., arrived in a "Gull" (Napier "Javelin") to take over the relay race—a remarkable piece of synchronisation. The pictures were handed over, and the remainder of the trip was completed in 50 hr., including stops, notwithstanding very bad weather, the machine arriving in England on Monday, the 18th, at 7.50 p.m. It is interesting to note that the round trip, Heston-Almaza-Heston, on the "Gull" was made in 38 hr. 25 min. actual flying time.

Another interesting flight, already reported in last week's FLIGHT, commenced on Sunday, September 17, when Capt. T. Neville Stack left for Bombay with a Harley Street surgeon, his anæsthetist and a nurse on board, in a new de Havilland "Dragon," the property of Airwork, Ltd.

Spartan Air Lines announce that the regular daily services between Cowes and Heston which they have been operating during the summer months will run for the last time this year on October 2. The machines are, however, being kept in readiness for charter work, and a service at the ordinary rate per passenger (55s. return) will be run at any time that a full complement of six passengers may be secured.

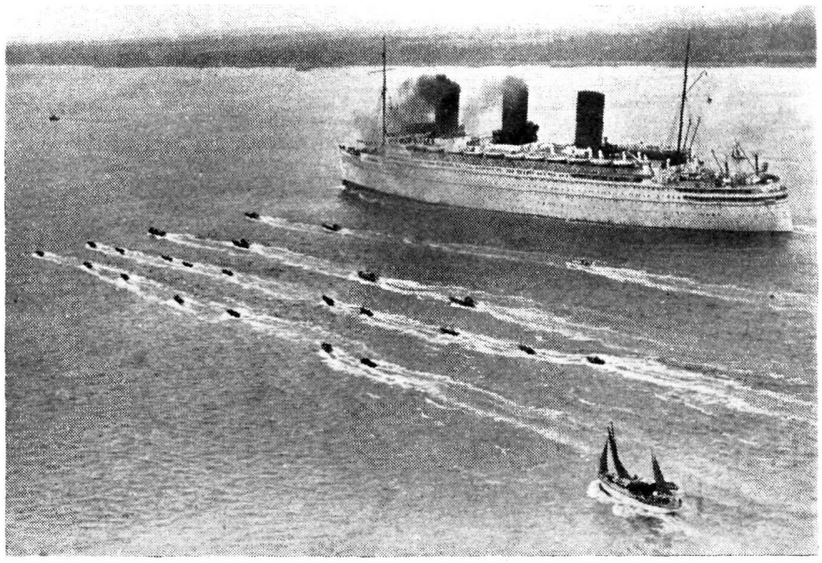
Mr. Pearse, of Wrightson & Pearse, arrived back from Lausanne on Friday, the 22nd, on a charter trip, and left that evening on another charter to Le Touquet. B.A.N.C.O. flew Lady Ludlow and her maid to Scotland in a "Dragon" on Friday, the 15th. A week later (the 22nd) they flew again to Scotland to take her from North Berwick to the Ayr races and home to Dunstable. Capt. Birkett, in the wireless-equipped Birkett Air Service "Puss Moth," spent an hour in fruitless search between Portland Bill and a point 30 miles S.W. of St. Catherine's Point for the missing mail-plane from the *Bremen*. Directed by wireless from Croydon, they finally abandoned the search, and arrived at Woolston Ferry simultaneously with the missing seaplane, which had been taken in tow by a fishing boat, and was able to proceed under its own power.

Fifty-six machines cleared Customs during the week ending Friday, September 22, among them being Air-Vice-Marshal Borton, Maj. Shaw, Miss Sale-Barker and Messrs. McClure, Clarkson, Norman, Leslie, Butler and Crammond, all of whom attended the Bienvenue Aérien at Rheims.

Miss Slade, Airwork Club Secretary, is back after a flying holiday with her father in Rome. They made the journey each way in three entirely uneventful flying days, spending two nights *en route*. The Prime Minister and his daughter arrived at Heston on Sunday, the 17th, after flying from Leeds in a "Leopard Moth" belonging to Sir Derwent Hall Caine.

The School has been exceptionally busy, and Airwork staff, who may not book ahead of regular pupils, have been unable to get a flight in edgeways. Count Fermo Murari Bra, who is living in the hotel, made his first solo flight this week after only 4 hr. and 40 min. dual instruction. He has now passed all the tests for his "A" licence, which he came to England to obtain. Capt. Trigona, the Italian Air Attaché, does a great deal of solo flying on Airwork School machines, as well as on his own Fiat aeroplane.

MISS BRITAIN III's ACHIEVEMENTS



A GOLIATH AMONG MANY DAVIDS : The *Empress of Britain* escorted up Southampton Water by a number of speed boats.

MR. HUBERT SCOTT-PAINE'S magnificent efforts to regain the British International Trophy for Great Britain, with his latest motor-boat, *Miss Britain III*, brings to light many interesting facts as to the extent to which he owes his success to the aircraft industry.

When he returned to Southampton in the *Empress of Britain* on Thursday, September 21, he admitted that his boat, its engine, shaft, rudder, propeller, and, in fact, every part caused a very big stir indeed in engineering circles both in Canada and the U.S.A. Eminent authorities came from all parts of those countries to look at these engineering marvels.

Mr. Scott-Paine himself designed and built the boat, but the engine, as our readers know, was a Napier "Lion" supercharged racing engine, series VII D., of the same type as was built for the Schneider Trophy Contest. Giving out 1,375 h.p. at 3,600 r.p.m., it has a power weight ratio of only 0.886 lb./h.p. Mr. Scott-Paine told us that during the race he ran at 3,500 r.p.m. all the time, and that at times the boat leapt from the water for considerable distances. The strain to which the engine must have been subjected at these times, and which it stood without giving any trouble, must have been incredible. Naturally, Napier's use the very best materials they can get in their engines, and for the steel for their crankshaft, pinions, lay-shafts, inlet valves, impeller, camshafts and reduction gearing and other parts they went to T. Firth & John Brown, Ltd. This same firm was responsible for producing a steel which stood up to the terrific shocks imposed on the main shaft and the rudder. The former was only one and a-half inches in diameter, and with the latter, which was placed in front of the step, was subjected to tremendous forces when the boat hit waves and when, as was shown by photographs, she leapt clean out of the water for distances of as much as 340 ft. Firth's shaft was made from 72.4-ton steel, with the extraordinarily high impact value of 80 to 82 ft.-lb. No less important was the propeller. With a shaft at an angle, as was that of *Miss Britain III*, the centrifugal force produces a complete reversal of stress in the propeller at every revolution, and the blades have to sustain almost incalculable shocks on re-entering the water after a jump. The propeller used was a solid casting of special bronze (Ammadium V) produced by the Manganese Bronze & Brass Co., Ltd. Mr. Scott-Paine had no trouble with this at all, although it was running at twice the engine speed. Instruments play a most important part in an undertaking of this nature, and the revolution indicator, pressure and temperature gauges, upon which so much depends, were all of aircraft type supplied by Smith's Aircraft Instruments, which firm was also responsible for supplying the Petro-Flex tubing, Essex fire extinguishers and the K.L.G. sparking plugs in the engine. Mr. Scott-Paine expressed his intention of building another boat to challenge again for the Trophy.

On Sunday afternoon, September 24, he broke the unofficial sea-mile record for single-engined boats, held by the late Sir Henry Segrave, at 92.73 m.p.h., raising it to 95.08 m.p.h. The runs were made in Poole Harbour, and during a subsequent demonstration for the crowd, which had arrived after his success, the boat burst into flames. These were, however, extinguished without very serious damage to the boat or to the engine, and Mr. Scott-Paine intends to make another effort shortly, as he is confident of raising the record to over 100 m.p.h.

Royal Aero Club House Dinners

IT has been decided to hold monthly house dinners in the club on the first Wednesday of each month, commencing on October 4 next. The price of dinner will be 4s. Dinner jackets will be worn. Mr. Leslie L. Irvin will speak on "Parachutes" at the first dinner, October 4, at 8.15 p.m. Members intending to be present are requested to forward their names to the House Secretary.

Control of Private Flying

THE Secretary of State for Air, having appointed a Committee, under the chairmanship of Lord Gorell, to examine the requirements of the present Air Navigation Regulations, with particular reference to those governing private flying, in such matters as Certificates of Airworthiness, the question of compulsory third-party insurance for aircraft having also been referred to them, the Royal Aero Club has been requested to put forward the names of three private owners to give evidence before the Gorell Committee. In order that the whole question may be ventilated, all private owners are invited to attend a meeting, to be held at the Royal Aero Club, 119, Piccadilly, London, W.1, on Thursday, October 5, 1933, at 5 p.m.

Junior Aero Club Annual Dinner

THE JUNIOR AERO CLUB will be holding their annual dinner at the Ham Bone Club, Ham Yard, Great Windmill Street, near Piccadilly, on October 3, at 8.0 p.m. The occasion is being made a reunion of "old timers," and Capt. Geoffrey de Havilland and Mr. "Bill" Lawford will be the chief guests. Lounge suits will be the "rig of the day," and tickets at four shillings each should be obtained from the Secretary, table being booked at the same time as accommodation is limited.

First Chinese Member of the Caterpillar Club

WHAT must surely be one of the lowest drops done with the aid of a parachute was safely accomplished in China recently, and it was entirely unpremeditated. Mr. Tang Pao Sun, of the Central Aviation School, Hangschow, leaped from a spinning Curtiss Hawk with an Irvin parachute from a height of 150 ft. and landed safely, thus qualifying for membership of the Caterpillar Club.

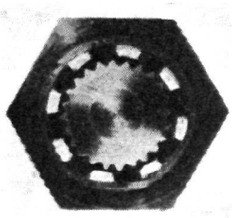
Tenders for Hangars Wanted

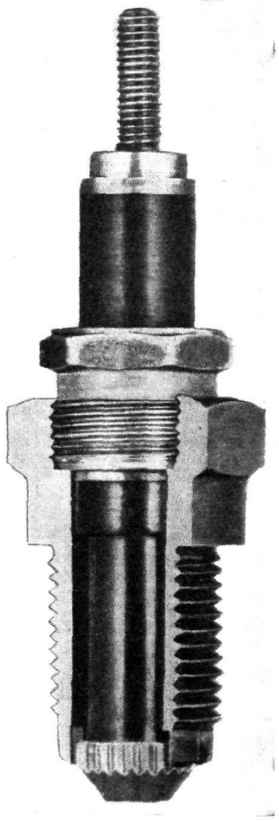
THE Egyptian Ministry of Communications, Aviation Department, is calling for tenders, to be presented in Cairo by November 1 of this year, for the building of two portable hangars at Dekheila and Mersa Matruh aerodromes. Details of the tender can be obtained from the Department of Overseas Trade, 35, Old Queen Street, London, S.W.1.

International Egyptian Aviation Meeting

DURING the International Egyptian Aviation Meeting the Vacuum Oil Co. have made arrangements to provide fuel and oil at all landing grounds on the route. Considering that some of the landing grounds are situated out in the Lybian desert, over which transport is very difficult, this shows very praiseworthy enterprise on the part of Vacuum Co., and it can only be hoped that every advantage will be taken of it.

The Industry.





THE WIZARD PLUG

THE Wizard Plug, produced by the Wizard Sparking Plugs Co., Stafford Road, Croydon, was first experimented with in the year 1930, and since has been extensively tested in all conditions under the supervision of the Air Ministry officials. In the production of this plug the aim has been to provide a plug as free as possible from short circuiting caused by the bridging of the sparking gap by carbon, oil, or other moisture. Another object was to construct a plug so that wear of the electrode from service and constant cleaning, which at present limits the life of a plug, should be reduced to a minimum. A notable feature is the particular form of the head of the electrode and the shape of the body of the plug which provide a considerable number of sparking points, and enable the insulating material to be directly exposed to, and scavenged by, the flames of combustion. In addition, a special annular space is provided between the insulating material around the central electrode and the inner body of the plug. Imperial Airways have, after considerable experience with all makes of sparking plugs, standardised on Wizard plugs. At the present time these plugs are in use in over 80 large aircraft engines operating on regular air lines. A number of Wizard plugs have been run over 2,000 hr. without cleaning or attention. The manufacturers would particularly emphasise the fact that these plugs have a number of important features which are entirely different to other makes and these are fully covered by British and foreign patents.

PISTON RINGS

IN a little booklet, entitled "The Choice of the Expert," Messrs. Wellworthy, Ltd., of 89, Blackfriars Road, S.E.1, set out their aims and the work which they do. Messrs. Wellworthy's turn out about 100,000 rings a week and reckon to have a stock of between one and two million rings, so that prompt service can be given. This firm was founded in 1919 to manufacture piston rings by a process patented by Messrs. Gray and Howlett. By this process rings are made from centrifugally cast chilled iron to a rigid specification of the highest quality, thereby ensuring unfailing uniformity and consistency of material. Following heat-treatment the castings are subjected to minute inspection before being utilised for ring production. The ring is machined and precision ground, undergoing fourteen distinct machining operations, including an automatically controlled internal hammering which ensures perfect circular form and equal radial pressure around its entire periphery. Chemical and physical tests are applied to each batch of rings manufactured to maintain uniformity of composition and pressure.

APPRECIATION

MR. T. WILLIAMSON, of the Air Taxi Co., Ltd., of South Africa, has written to the Airscrew Co., Ltd., of Weybridge, Surrey, expressing his satisfaction with the airscrew fitted to his Koolhoven monoplane. He recently completed a flight in search of the missing Swiss airman, Carl Nauer. The area covered was over 11,000 miles through seven different countries—South West Africa, Angola, French Equatorial Africa, Belgian Congo, Northern Rhodesia, Southern Rhodesia and South Africa. During the month he was away the machine was never housed, but was exposed to severe climatic conditions, exceedingly heavy fog by night, and extreme heat by day. Mr. Williamson says it was indeed a thorough test for the airscrew, and that on arrival back in Cape Town it was found to be in exactly the same condition as when he started.

Mr. Williamson has also written to the Cirrus Hermes Engineering Co., Ltd., of Croydon, regarding the "Hermes II" fitted in the Koolhoven. He writes that although the engine had to operate under extremely trying climatic conditions, it never dropped a rev., although at different times he was unable to obtain the correct grade of oil and had to use unsuitable lubricants. On arrival back in Cape Town the engine was given the usual inspection and needed no replacement, barring one cracked engine-bearer foot.

Finally, our good friends, Cellon, Ltd., of Kingston, have also received a word of praise in respect to the Dope on this machine.

BRIEFLY

IT is rumoured that de Havillands will, before very long, have on the market a small engine of some 75 h.p., which will be a radical departure from their existing designs. The tendency of recent years on the part of many manufacturers has been towards the radial engine for small horse-powers, and this method certainly provides a way of securing a smooth running.

WE hear, unofficially, that the Pobjoy engine will be available with two alternative gear ratios for next year.

EXTENSIVE developments in Continental traffic are expected if negotiations at Ipswich, which are now in progress, are brought to a successful conclusion. The aerodrome management is in the hands of Brian Lewis, Ltd.

MONOSPAR aeroplanes are now in service in England, Scotland, the Irish Free State, Sweden, Switzerland, Italy, North Africa, India, Japan, and Brazil, and are being used for:—Desert service, Government communication services, newspaper conveyance, staff transport, night flying services, air taxi and ferry services, schedule air routes, club instruction, joy-riding and by private owners.

BROWN BROS., LTD., of Great Eastern Street, London, E.C.2, are the sole export concessionaires for the "Sestrel" aero compass and the "Sestrel" combined bearing plate and drift indicator.

THE Chairman of the Junior Aero Club dinner, which is being held at the Ham Bone Club on Tuesday next, October 3, will be Lt. Col. J. T. C. Moore-Brabazon, who holds the R.Ae.C. Aviator's Certificate No. 1.

THE first of the season's dances will be held by the Reading Aero Club, in their club-house at Reading Aerodrome, Woodley, at 8.45 p.m. on October 7.

MISS BIRMINGHAM will be holding another of her unique parties for aviation people at the "Dubarry" Restaurant, 214, Piccadilly, London, W.1, at 8.30 p.m., on Saturday, October 7.

BRITISH THOMSON-HOUSTON, LTD., have acquired the sole manufacturing and selling rights for the British Empire of the Caple engine starter, which was described in FLIGHT for March 9, 1933.

THE ROYAL AIR FORCE

London Gazette, Sept. 19, 1933

General Duties Branch

The follg. are granted short-service commissions as Acting Pilot Officers on probation with effect from and with seny. of Sept. 1 :—H. V. Alloway, S. S. Bertram, A. P. W. Cane, K. Capel-Cure, E. L. Colbeck-Welch, L. P. Gibson, H. A. R. Holford, G. E. Jackson, V. H. A. McBratney, A. M. Mulliken, C. P. L. Nicholson, J. J. J. Page, C. R. Paylor, B. V. Robinson, E. U. G. Solbé, G. J. D. Thomson, R. H. Waterhouse, S. G. White.

Pilot Officer W. H. Mitchell is promoted to the rank of Flying Officer (Sept. 1).

The follg. Flying Officers are transferred to the Reserve (Sept. 14) :—Class A.—B. A. Blythe, A. L. Brain, H. R. Collins, H. A. Fenton, H. R. Hughes-Hallett, F. A. McNeill, G. O. St. J. Morris, M. P. O'Reilly, K. W. Pell, A. F. Powell, L. P. Rowley, D. F. Satchwell, J. S. Shakespeare. Class C.—J. E. Beynon, C. M. D. Chambers, C. C. C. Manson, C. Ray.

Wing Comdr. E. A. B. Rice, M.C., is placed on the half-pay list, Scale A, from Sept. 5 to Oct 14 inclusive ; Sqdn.-Ldr. E. J. D. Routh is placed on the half-pay list, Scale A (Sept. 12) ; Flt. Lt. F. C. Farrington, M.C. (Lt., Royal Artillery, R.A.R.O.), is transferred to the Reserve, Class C (Aug. 20). (Substituted for the notification in the *Gazette* of Aug. 22.) Flt.-Lt. E. A. Sullock, A.F.C., is transferred to the Reserve, Class B (Stores Branch) (April 16). (Substituted for the notification in the *Gazette* of May 16.) Flying Officer D. L. Iremonger resigns his short-service commission (Jan. 6) ; Flying Officer J. E. C. McClure resigns his short-service commission (Sept. 8) ; Flying Officer E. D. A. Bigg relinquishes his short-service commission on account of ill-health (Sept. 20).

Memorandum

74982 Cadet N. Borchardt is granted an honorary commission as a Sec. Lt. with effect from the date of his discharge.

ROYAL AIR FORCE RESERVE
RESERVE OF AIR FORCE OFFICERS

General Duties Branch

The follg. Pilot Officers on probation are confirmed in rank :—C. F. Almond (April 3) ; E. B. Nelson (April 17) ; N. S. T. Benson (Aug. 3) ; F. G. Frow (Aug. 29).

Flt.-Lt. A. M. Blake, A.F.C., is transferred from Class A to Class C (Sept. 16).

The follg. Flying Officers are transferred from Class AA (ii.) to Class C :—R. S. Sikes (June 5) ; E. L. Purdy, M.C. (Sept. 16).

The follg. Flying Officers relinquish their commissions on completion of service :—G. J. E. Howard (July 10) ; C. W. Switzer (Sept. 15) ; C. A. Jamblin (Sept. 18).

Flying Officer A. E. Ansell relinquishes his commission on completion of service and is permitted to retain his rank (Sept. 16) ; Pilot Officer G. A. Hornblower relinquishes his commission on account of ill-health (Sept. 20) ; Pilot Officer G. E. Jackson relinquishes his commission on appointment to a short-service commission in the Royal Air Force (Sept. 1) ; the notification in the *Gazette* of Nov. 15, 1932, concerning Flying Officer V. A. C. Ross is cancelled.

AUXILIARY AIR FORCE

General Duties Branch

No. 603 (City of Edinburgh) (Bomber) Squadron.—Flying Officer J. E. Glenny relinquishes his commission on completion of service (July 11).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Air Commodore H. R. Nicholl, C.B.E., to No. 23 Group H.Q., Grantham, 18.9.33, to command, *vice* Air-Com. P. H. L. Playfair, C.B., M.C.

Group Captains : W. B. Callaway, A.F.C., to R.A.F. Base, Calshot, 9.9.33, to command, *vice* Air-Com. H. R. Nicholl, C.B.E. A. C. Maund, C.B.E., D.S.O., to Aeroplane and Armament Experimental Estab., Martlesham Heath, 17.9.33, to command, *vice* Group-Capt. H. L. Reilly, D.S.O. F. L. Robinson, D.S.O., M.C., D.F.C., A.D.C., to Station H.Q., Amman, to command, *vice* Group-Capt. I. G. V. Fowler, A.F.C., 1.9.33.

Wing Commander H. I. Hanmer, D.F.C., to H.Q., Iraq Command, Hinaidi, 14.9.33, for duty as Senior "P" Staff Officer, *vice* Wing-Com. F. H. M. Maynard, A.F.C.

Squadron Leaders : S. L. G. Pope, D.F.C., A.F.C., to No. 801 (F.F.) Sqdn., 13.9.33, to command, *vice* Sqdn.-Ldr. C. E. W. Foster. Edward F. Turner, A.F.C., to H.Q., R.A.F., Mediterranean, 15.9.33, for "P" staff duties, *vice* Flt.-Lt. J. M. J. C. J. I. Rock de Besombes.

Flight Lieutenants : G. Harcourt-Smith, to Marine Aircraft Experimental Estab., Felixstowe, 10.9.33. J. D. Breakey, D.F.C., to R.A.F. Base, Calshot, 18.9.33. H. Broadhurst, to R.A.F. Base, Calshot, 18.9.33. B. H. Ashton, to No. 99 (B.) Sqdn., Upper Heyford, 14.9.33. H. H. V. Tristem, to Station H.Q., Boscombe Down, 12.9.33. E. B. Webb, to R.A.F. Training Base, Leuchars, 11.9.33. A. H. Wheeler, to No. 1 (F.) Sqdn., Tangmere, 14.9.33. E. C. T. Edwards, to No. 820 (F.S.R.) Sqdn., 13.9.33.

Flying Officers : R. H. E. Emson, to No. 821 (F.S.R.) Sqdn., 7.9.33. The Hon. G. R. Ward, to No. 812 (F.T.B.) Sqdn., 6.9.33. G. W. Montagu, to No. 822 (F.S.R.) Sqdn., 7.9.33.

Pilot Officers : J. B. Altham, to No. 9 (B.)Sqdn., Boscombe Down, 28.8.33.

C. H. B. Bullock, to No. 10 (B.) Sqdn., Boscombe Down, 28.8.33. P. Y. Davoud, to No. 17 (F.) Sqdn., Upavon, 28.8.33. D. Price, to No. 25 (F.) Sqdn., Hawkinge, 28.8.33. G. E. Watt, to No. 18 (B.) Sqdn., Upper Heyford, 28.8.33.

Acting Pilot Officers : P. B. H. Butler, to No. 25 (F.) Sqdn., Hawkinge, 28.8.33. W. G. Devas, to No. 29 (F.) Sqdn., North Weald, 28.8.33. W. B. Fleming, to No. 32 (F.) Sqdn., Biggin Hill, 28.8.33. D. W. H. Gardner, to No. 12 (B.) Sqdn., Andover, 28.8.33. E. P. P. Gibbs, to No. 41 (F.) Sqdn., Northolt, 28.8.33. G. J. Grindell, to No. 23 (F.) Sqdn., Biggin Hill, 28.8.33. H. V. Kennedy, to No. 41 (F.) Sqdn., Northolt, 28.8.33. P. C. Lawrence, to No. 57 (B.) Sqdn., Upper Heyford, 28.8.33. J. S. Leslie, to No. 33 (B.) Sqdn., Bicester, 28.8.33. J. S. McLean, to No. 32 (F.) Sqdn., Biggin Hill, 28.8.33. G. A. M. Pryde, to No. 57 (B.) Sqdn., Upper Heyford, 28.8.33. D. S. Radford, to No. 111 (F.) Sqdn., Hornchurch, 28.8.33. J. R. L. Rumsey, to No. 58 (B.) Sqdn., Worthy Down, 28.8.33. P. H. P. Simonds, to No. 207 (B.) Sqdn., Bircham Newton, 28.8.33. E. L. A. Walter, to No. 56 (F.) Sqdn., North Weald, 28.8.33. C. H. T. Warner, to No. 207 (B.) Sqdn., Bircham Newton, 28.8.33.

Stores Branch

Flight Lieutenant G. L. Worthington, to Station H.Q., Farnborough, 6.9.33.

Medical Branch

Squadron Leader H. McW. Daniel, to Princess Mary's R.A.F. Hospital, Halton, 6.9.33, for duty as Medical Officer.

Flight Lieutenant G. H. J. Williams, to No. 6 (B.) Sqdn., Ismailia, 17.8.33.

Flying Officers : L. S. Everett, G. Gilchrist and W. P. Griffin, to Med. Training Depot, Halton, on 4.9.33, on appointment to short service commns. T. C. Macdonald, to No. 5 Flying Training School, Sealand, 18.9.33. A. H. Osmond, to Station H.Q., Netheravon, 18.9.33.

Royal Air Force Awards

The King has approved the follg. rewards in recognition of gallant and distinguished services rendered in connection with the operations on the North-West Frontier of India during the periods January 28, 1932, to February 6, 1932, and March 6, 1932, to March 18, 1932 :—

Awarded a Second Bar to the Distinguished Flying Cross.—Sqd. Ldr. S. B. Harris, D.F.C., A.F.C.

Awarded the Distinguished Flying Cross.—F/O. (now Flt. Lt.) J. B. Fyfe.

Awarded a Bar to the Distinguished Flying Medal.—363389 Corporal R. W. Ellis, D.F.M.

The names of the follg. have been brought to notice by Air Marshal Sir John Steel, Air Officer Commanding, R.A.F., India, for distinguished services rendered in connection with the operations on the North-West Frontier of India during the periods January 28, 1932, to February 6, 1932, and March 6, 1932, to March 18, 1932 :—Flt. Lt. F. H. Isaac, D.F.C., Flt. Lt. S. McKeever, D.F.C., F/O. N. Kirkham.

The King has approved the follg. rewards in recognition of gallant and distinguished services rendered during the operations in connection with the Chitral Reliefs, September to October, 1932 :—

Awarded the Distinguished Flying Cross.—Flt. Lt. F. G. A. Robinson, Flt. Lt. C. J. Collingwood, Flt. Lt. J. E. Gray-Hill Thomas.

Awarded the Distinguished Flying Medal—370054 Corpl. A. I. Steer, 370030 Corpl. L. J. Strevens, 363282 Corpl. R. Wright.

Royal Air Force.—Changes in the Higher Commands

The Air Ministry announces the following appointment : Air Commodore John Eustace Arthur Baldwin, D.S.O., O.B.E., now Senior Air Staff Officer, Fighting Area, to be Air Officer Commanding, No. 1 Air Defence Group, in February, 1934, *vice* Air Commodore William Foster MacNeece Foster, C.B., C.B.E., D.S.O., D.F.C.

Air Commodore J. E. A. Baldwin was seconded to the Royal Flying Corps from the 8th Hussars early in 1915 after graduating at the Central Flying School (Royal Aero Club Certificate No. 971). During the War he served in France having been in command of No. 41 Wing in 1917 and reached the rank of Lieutenant-Colonel in 1918, in which year he assumed command of No. 1 School of Navigation and Bomb Dropping. The following year he was granted a permanent commission in the Royal Air Force and in 1923 he graduated at the Royal Air Force Staff College. Following several years engaged on staff duties at the Middle East Command Headquarters he was given command of the Central Flying School in 1929. Since January, 1932, he has served at the Headquarters Fighting Area, where he was promoted Air Commodore and became Senior Air Staff Officer early this year. From August, 1931, to December, 1932, he acted as Air Aide-de-Camp to the King.

For his services in France during the War he was awarded the D.S.O. in 1918 and the O.B.E. in 1919, besides being mentioned three times in despatches. He also holds a Belgian Order and a decoration.

R.A.F. Changes

Headquarters, Central Area, R.A.F., will form with effect from October 1, 1933. The location of this headquarters will be at Abingdon. Wessex Bombing Area will be known as "Western Area, R.A.F.," as from October 1, 1933. Consequent upon the formation of Central Area, R.A.F., the following will be the distribution of units between Western Area, R.A.F., Central Area, R.A.F., and No. 1 Air Defence Group :—*Western Area, R.A.F.*—Flying units stationed at Aldergrove, Andover, Boscombe Down, Manston—No. 500 (Bomber) Squadron only, Waddington, Worthy Down. *Central Area, R.A.F.*—Units stationed at Abingdon, Bicester, Bircham Newton, Filton, Hucknall, Upper Heyford. *No. 1 Air Defence Group.*—Units stationed at Abbotsinch, Castle Bromwich, Hendon, Thornaby, Turnhouse, Usworth. The dates on which executive control of regular units is to be assumed by Central Area, R.A.F., and the date on which cadre squadrons are to be transferred from No. 1 Air Defence Group to Western Area, R.A.F., and Central Area, R.A.F., will be decided by the A.O.C.-in-C., Air Defence of Great Britain.

AIRCRAFT COMPANIES' STOCKS AND SHARES

DURING the past month the industrial section of the Stock Exchange has been less active, sentiment having been affected by uncertainties regarding the European situation, but a steady undertone was maintained throughout. Shares of companies operating in the aircraft and allied industries remained in good demand despite the general tendency, and there were numerous advances on balance. The new departure of Rolls-Royce in commencing interim dividends with a payment of 5 per cent. created a favourable impression. Although they went "xd" on Monday, the company's shares are 62s. 3d., compared with 57s. 6d. a month ago. Reports remain current in the market that the aero engine side of the business is doing well, and hopes of an increase in the total dividend for the year persist. Imperial Airways also moved up further on balance, being 30s. 7½d. at the time of writing in response to continued hopes of a small increase in the dividend. The latter is expected to be declared shortly. Fairey Aviation, another share which continued to benefit from favourable dividend estimates, are again higher on the month at 26s. 3d., compared with 25s. 6d., while de Havilland remained firm at 23s. 9d. Hawker Aircraft were more active and higher than a month ago at 14s. 4½d., while the preference are 19s. 4½d., against 18s. 9d.; D. Napier are 6s. 6d., against 5s. 6d., but both classes of preference shares are unchanged. Handley Page preference, to which reference was made last month, are little changed around 10s. at the time of writing. Petters continue to be held firmly, and few markings of business have been recorded in either the ordinary or preference for some time. In other directions there was active business in S. Smith (M.A.) preferred and deferred, which were both higher on balance for the month, having reflected hopeful market views of dividend prospects. British Oxygen are nearly 5s. up on the month, assisted by anticipations of a favourable interim dividend being announced in October, and during the same period the Birmingham price for British Piston Ring has been advanced from 42s. 6d. to 53s. 9d. in response to buying on anticipations of a larger dividend. James Booth also had a large rise at Birmingham. Brown Brothers moved up from 40s. 6d. to 42s. 6d. Armstrong-Siddeley Development preference are better at 21s. 10½d., against 21s. last month. Vickers, which were rather dull, moved within narrow limits. Elsewhere Triplex Safety Glass remained prominent throughout under the influence of the past year's results, and the statements at the recent annual meeting. Although they went "xd" on Monday, they have had a large rise from 59s. to 73s. during the month. "Shell" and other leading oil shares have been more active, accompanied by the view current in the market that an increase in the price of petrol may be put into force in the near future.

Name	Class	Nominal Amount of Share	Last Annual Dividend	Current Week's Quotation
		%		
Anglo-American Oil	Deb.	Stk.	5½	102
Armstrong-Siddeley Develop	Cum. Pref.	£1	6½	21/10½
Birmingham Aluminium Castg.	Ord.	£1	5	27/3
Booth (James), 1915	Ord.	£1	15	67/9
Do. do.	Cum. Pref.	£1	7	27/6
British Aluminium	Ord.	£1	5	28/9
Do. do.	Cum. Pref.	£1	6	25/–
British Celanese	Ord.	10/–	Nil	14/9
British Oxygen	Ord.	£1c	6½	38/9
Do. do.	Cum. Pref.	£1c	6½	27/6
British Piston Ring	Ord.	£1	12½	53/9
British Thomson-Houston	Cum. Pref.	£1	7	28/9
Brown Brothers	Ord.	£1	10	42/6
Do. do.	Cum. Pref.	£1	7½	29/4½
Dick (W. B.)	Cum. Pref.	£10	5	117/6
De Haviland Aircraft	Ord.	£1	2½	23/9
Dunlop Rubber	Ord.	c	4	34/–
Do. do.	"C" Cum. Pref.	16/–	10	26/6
En-Tout-Cas (Syston)	Def. Ord.	1/–	Nil	–/6
Do. do.	Ptg. Ptd. Ord.	5/–	Nil	2/10½
Fairey Aviation	Ord.	10/–	10*	26/3
Firth (T.) & John Brown	Cum. Pref.	£1	6D	7/6
Do. do.	Cum. Pref.	£1	5*D	8/–
Ford Motor (England	Ord.	£1	Nil	23/3
Fox (Samuel)	Mt. Deb.	Stk.	5	82½
Goodyear Tyre and Rqbber	Deb.	Stk.	6½	104
Handley Page	Ptg. Pref.	8/–	10	10/–
Hawker Aircraft	Ord.	5/–	B	14/4½
Do. do.	Red. Cum. Pref.	£1	B	19/4½
Hoffmann Manufacturing	Ord.	£1	5	24/–
Do. do.	Cum. Pref.	£1	7½	25/–
Imperial Airways	Ord.	£1	3	30/7½
Kayser, Ellison	Ord.	£5	Nil	50/–
Do. do.	Cum. Pref.	£5	6	70/–
Lucas (Joseph)	Ord.	£1	20	102/–
Napier (D.) & Son	Ord.	5/–	Nil	6/6
Do. do.	Cum. Pref.	£1	7½	22/6
Do. do.	Pref.	£1	8A	15/7½
Petters	Ord.	£1	Nil	7/6
Do.	Cum. Pref.	£1	7½G	10/–
Roe (A. V.) (Cont. by Armstrong-Siddeley Devel., *q.v.*)	Ord.	£1	—	—
Rolls-Royce	Ord.	c	10	62/3 xd.
Smith (S.) & Sons (M.A.)	Def. Ord.	1/–	Nil	5/–
Do. do.	Pt.Pfd. Ord.	£1	7	46/3
Do. do.	Cum. Pref.	£1	7½	24/4½
Serck Radiators	Ord.	£1	12½	39/3
"Shell" Transport and Trading	Ord.	£1	7½*	54/4½
Do. do.	Cum. Pref.	£10	5	£11¾
Triplex Safety Glass	Ord.	10/–	25	73/– xd
Vickers	Ord.	6/6	4	7/9
Do.	Cum. Pref.	£1	5*	21/6
Vickers Aviation (Cont. by Vickers, *q.v.*)	—	—	—	—
Westland Aircraft (Branch of Petters, *q.v.*)	—	—	—	—

* Dividend paid, tax free. c £1 unit of stock. D Last xd. March, 1931. A Last xd. September 1931. B Issued this year. G Last xd. July, 19 1932.

IMPORTS AND EXPORTS

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910).

For 1910 and 1911 figures see FLIGHT for January 25, 1912.
For 1912 and 1913, see FLIGHT for January 17, 1914.
For 1914, see FLIGHT for January 15, 1915, and so on, yearly, the figures for 1932 being given in FLIGHT, January 19, 1933.

	Imports		Exports		Re-exports	
	1932.	1933.	1932.	1933.	1932.	1933.
	£	£	£	£	£	£
Jan. ..	2,456	2,073	122,942	82,963	863	827
Feb. ..	2,503	9,866	181,482	79,357	90	3,050
Mar. ..	1,946	3,760	167,195	126,008	200	821
April ..	622	2,236	142,145	121,030	1,128	94
May ..	1,747	232	138,356	149,214	5	—
June ..	398	1,021	126,330	137,186	125	2,037
July ..	1,070	4,806	142,702	75,634	120	2,520
Aug. ..	511	284	111,073	96,368	3	2,000
	11,253	24,303	1,132,225	860,830	2,534	11,349

PUBLICATIONS RECEIVED

Capt. Albert Ball, V.C., D.S.O. By R. H. Kiernan. London: John Hamilton, Ltd. Price 8*s.* 6*d.* net.

Conquering the Air. By Archibald Williams. London: T. Nelson & Sons, Ltd. Price 3*s.* 6*d.* net.

An Airman Marches. By H. H. Balfour. London: Hutchinson & Co. (Publishers), Ltd. Price 18*s.* net.

Amateur Pilot. By the Earl of Cardigan. London: G. P. Putnam & Sons, Ltd. Price 7*s.* 6*d.* net.

The Armstrong-Siddeley Air Mail. Vol. 3, No. 1. Armstrong-Siddeley Motors, Ltd., Coventry.

The Official Gazette of the United States Patent Office. By the Department of Commerce, U.S. Patent Office, Washington, D.C. August-September. Price 35 cents.

The Canadian Patent Office Record and Register of Copyrights and Trade Marks. August 22 and 29. Price 25 cents.

NEW COMPANY REGISTERED

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AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: Cyl. = cylinder; i.c. = internal combustion; m. = motors.
(The numbers in brackets are those under which the Specification will be printed and abridged, etc.)

APPLIED FOR IN 1931

Published September 28, 1933

33,370. DUNLOP RUBBER CO., LTD., E. F. GOODYEAR, J. WRIGHT, and H. TREVASKIS. Aircraft-wheel braking systems. (397,895.)

33,371. DUNLOP RUBBER CO., LTD., E. F. GOODYEAR, J. WRIGHT, and H. TREVASKIS. Aeroplane brakes. (397,896.)

33,372. DUNLOP RUBBER CO., LTD., E. F. GOODYEAR, J. WRIGHT, and H. TREVASKIS. Aeroplane brakes. (397,897.)

APPLIED FOR IN 1932

Published September 28, 1933

2,227. BENDIX AVIATION CORPORATION. Combustion spaces of direct-injection oil engines. (397,840.)

12,088. AIRSPEED, LTD., and A. TILTMAN. Aeroplanes. (397,964.)

35,352. J. ALBESSARD. Aeroplanes with autostable arrangements of planes. (398,069.)

APPLIED FOR IN 1933

Published September 28, 1933

5,264. AKTIESELSKABET DANSK REKYL-RIFFEL SYNDIKAT. Dismemberable mountings for anti-aircraft guns, etc. (398,103.)

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MURRAY : SMITH.—The engagement is announced between FLT.-LT. JOHN GORDON MURRAY, second son of Mr. and Mrs. R. A. Murray, of Leitchland, Dunoon, Argyllshire, and AILSA CATHCART, daughter of Mr. and Mrs. J. Macpherson Smith, 24, Berkeley Sq., London, W.1.

Death.

FEW.—On September 16, 1933, at Weybridge, Surrey, the result of an accident, FLYING OFFICER LESLIE MAURICE FEW, son of Mr. and Mrs. Edwin Few (late of Highbury), age 29 years. Funeral service at St. Stephen's Church, Bexhill, to-day (Thursday) at 1.30 p.m., and afterwards at Bexhill Cemetery.

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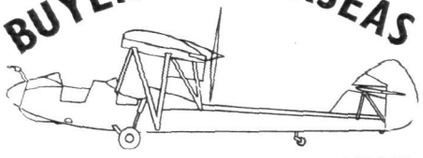

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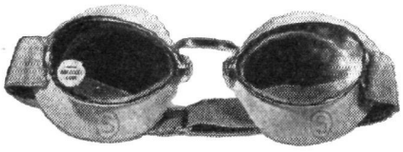

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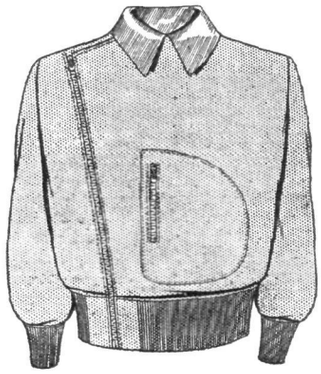

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